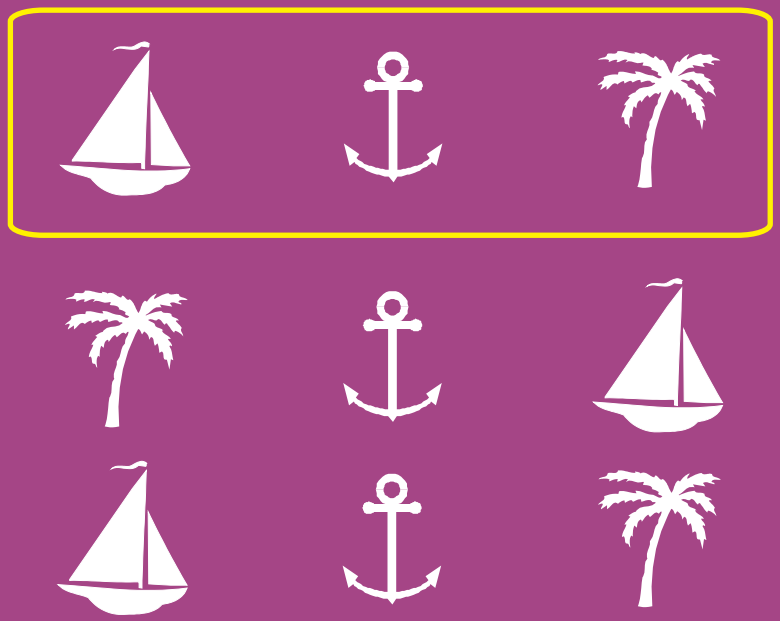
# TRAINING ACTIVITIES FOR VISUAL-PERCEPTUAL SKILLS

## ACTIVIDADES DE ENTRENAMIENTO DE HABILIDADES VISO-PERCEPTIVAS

### Visual-Sequential Memory (Basic Level)

### Memoria Viso-secuencial (Nivel Básico)

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Authors: Gimeno-Galindo, Patricia; Vidal-López, Joaquín; Rodán-González, Antonio; Javaloyes-Moreno, Beatriz; Muiños-Durán, Mónica; Rifá-Giribet, Montserrat; Codina-Fossas, Marta; García-Montero, María

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# TRAINING ACTIVITIES FOR VISUAL SEQUENTIAL MEMORY

The term visual perception refers to the ability of the brain to understand and interpret what the eyes see (Gardner, 1986; Scheiman, 1997). Along with basic visual functions and motor skills, visual perception skills allow us to carry out many activities of daily life (Chaikin and Downing-Baum, 1997; Erhardt and Duckman, 2005; Goodale and Milner, 2009; Jeannerod, 2006; Van Waelvelde, De Weerdt, De Cock and Smits-Engelsman, 2004). In fact, in our daily lives we do not perceive a world composed of isolated visual stimuli, we are in an environment with multiple stimuli and sometimes, these are presented in dynamic conditions.

The memory is defined as the ability to store past events and be able to retrieve this information when it is necessary or useful for the subject. By means the memory we know who we are and our life makes sense of continuity (Ruiz-Vargas, 1995).

Some researchers (Graf and Schacter, 1985; Schacter, 1985) have proposed that we acquire information about ourselves and the environment through experiences that we record, store and retrieve by different memory systems, because memory system is a set of related processes (Tulving, 1985).

If one takes into account the duration of memory processes, it can be divided into sensorial memory, working memory or short-term and long-term memory.

Sensorial memory (Sperling, 1960) has a very short duration, around a few milliseconds, and can reach out successfully the various processes that occur during the initial perception of stimuli.

Working, short-term or primary memory (James, 1890) is longer, prolonging until 10 or 15 seconds, its function is to store and retrieve information from something that just happened.

Long-term memory can last for weeks, months or even a lifetime, it stores information of different nature, as experienced memories, images and concepts. It is considered the "database" which consolidates information, which comes from the short-term memory, in order to subsequently make use of it. Both the procedural memory, such as declarative memory are sub-memory systems within the long-term memory.

Procedural memory stores information about sensations, procedures and strategies to interact with the environment, so that its "implementation" takes place unconsciously or automatically (Tulving, 1987). While declarative memory stores information about events, people, places or things that are remembered by strengthening awareness (Tulving, 1987).

Two other memory systems related to the long-term memory are semantic memory (Schacter and Tulving, 1994), which stores knowledge about the meanings of words, and episodic memory (Schacter and Tulving, 1994), which represents events which reflect details of the situation, not only of meaning.

However, all memory systems commented so far, working memory or short memory allows making available the relevant information so you can carry out some behavior.

Sometimes the terms short memory and working memory are used indistinctively. However, both terms connote different aspects. While the short term memory refers only to storing information in the short term, the concept of working memory would include the same processes of storage, along with the time to plan and guide our behavior (Baddeley and Della Sala, 1998, Baddeley and Hitch , 1974), so the working memory is involved in higher order cognitive tasks (Gathercole and Alloway, 2006), as the understanding of spoken and written language (Daneman and Merikle, 1996), mathematics (Adams and Hitch, 1997), reasoning, monitoring instructions (Engle, Carullo and Collins, 1991) and problem solving (Baddeley, 1986).

Much of the information we acquire in daily life is carried out visually, recording, storing and retrieving this information through a system of visual memory. This visual information can be numbers, letters, words, texts, figures, objects, faces, landscapes, actions, etc. When multiple visual stimuli are presented to individuals, but among them there is a lapse of time or when it is presented all together in order to memorize, it is said that the task requires a visual sequential memory demand.

Both visual memory and visual sequential memory are an important part of processing visual information and they participate in many academic activities and daily life. They are also very important for learning processes, as over 80% of these are acquired visually.

Often teachers and educators use visual memory as an educational resource and increasingly using audio-visual methods to facilitate the introduction of content in order to avoid fatigue and boredom of the students. There is also widespread use of drawings, figures, diagrams and pictures in textbooks. Another educational resource is widely used underline words, phrases or concepts in any color for easy recall (in this case the memory would be the visual color associated with the phrase or word). Moreover, visual memory is a skill that is demanded in the field of new technologies such the television or internet.

A study of Agam et al. (2009) was shown that there is neural activity in visual areas during certain tasks in the short memory, so visual areas contribute to the temporary storage of visual information for use it in tasks to be undertaken later.

The involvement of working memory in these cognitive functions that are essential to achieve optimum performance in academic, work or sports, makes its study relevant to applied disciplines such as Optometry, Occupational Therapy and Educational Psychology.

In the literature there is some consensus that the ability to control attention is one of the determining factors in the performance of an individual to perform tasks related to the working memory (Engle, 2002; Kane, Bleckley, Conway and Engle, 2001).

It also has seen that the ability to store information on the working memory is limited (Baddeley, 2003; Engle, Cantor and Carullo, 1992; Luck and Vogel, 1997; Miller, 1956). The results given in literature regarding the ability of the working memory are quite varied, as they depend largely on the context in which the studies are developed as well as models and measuring instruments used (Ollis, Button and Fairweather, 2005; Towse, Hitch and Hutton, 2000). In addition, any task of working memory can be made more complex by adding stimulus to cause interference during the process of memorization (Costa, Alario and Caramazza, 2005; Goolkasian and Foos, 2005).

Another aspect that affects the variability of results is the time between the stimuli used during testing (De Fockert, Rees, Frith and Lavie, 2001; Hashimoto et al., 2006).

Miller (1956) estimated the size of memory in tasks of working visual memory, when a series of stimuli are presented, is about 7 items in young adults, while Luck and Vogel (1997) suggested that the ability of the working memory is limited by the number of items presented (four), and it is independent of the load or number of bits of information that contains each of them. However, some authors have estimated that the memory capacity of working memory in visual tasks is dependent on the load information of the stimuli used and it can vary between four and six items (Alvarez and Cavanagh, 2004; Jiang, Olson and Chun, 2000; Luck and Vogel, 1997; Pashler, 1988; Simons, 1996).

It is also believed that the extent of working memory tasks depends on the visual vocabulary and semantic content of stimuli presented (Hulme, Roodenrys, Brown and Mercer, 1995).

It is possible that the difference of sex is also a determining factor in the ability of the working memory. A recent study conducted by Harness, Jacot, Scherf, White and Warnick (2008) have shown that women are able to reproduce more of the visual stimuli than men in working memory visual tasks, although these authors should be made other studies to assess this aspect in more detail as the results are inconsistent with those obtained in some previous studies (Ionescu, 2000 and 2004; Kail and Siegel, 1978).

Moreover, the process of encoding, storage and recovery that occurs in working memory visual tasks can be altered when increases the difficulty of the task (Cowan, Johnson and Saults, 2005, Goh and Pisoni, 2003; Goolkasian and Foos, 2005; Tremblay, Nicholls, Parmentier and Jones, 2005). However, there is not always a simple relationship between increasing the difficulty of the task and the ability to retain information. For example, Oberauer and Suss (2000) reported that subjects who were able to retain a larger number of items were also able to use more complex strategies when the increasing difficulty of the task, we have shown that some complex objects as faces, take longer to fade in memory than other simple visual stimuli, the orientation of lines (Jiang, Shim and Makovski, 2008).

Despite our limited ability to memorize, most objects are composed of multiple attributes or characteristics. We can voluntarily store a single attribute of an object without having to store all of their other characteristics, controlling and selecting which attributes are stored in the visual working memory (Woodman and Vogel, 2008).

It has been suggested (Ericsson and Kintsch, 1995; Just and Carpenter, 1992) that knowledge and skills or experience acquired thought the time determine the storage capacity, handling and retrieval of information in the working memory.

Based on the above considerations, Cowan (1995) suggested that the working memory would not be an independent entity, but as part of the long- term memory. In his model of memory representations in the working memory would be a subset of the active representations of the long- term memory. In fact, the results obtained by Chi (1978) a few years earlier showed that young children experts in the chess game were able to recall a greater number of positions of the pieces that adult novices in this game, although their ability to memorize a series of digits was lower than in adults.

In the same way, studies of Bower (1972) showed a relationship between capacity of working memory and long- term memory. In his experiments to assess the

extent of memory through oral and visual presentation with a series of letters grouped together and separated by pauses, found that the results were more favorable in those subjects in which the series of letters were grouped in acronyms previously known by the subjects.

Much of the coded information is stored in the long term memory, and thus current information available is associated with the information from the past through recovery processes (Ericsson and Delaney, 1999; Ericsson and Kintsch, 1995).

Visual perceptual skills of children are not at the same level as for the adult, but their perception of the world remains good (Arterberry, 2008). However, any factor that interferes with the children's ability to explore their environment may impede the visual perceptual learning process (Tsai, Wilson and Wu, 2008), adversely affecting the ability to perform activities of daily live, such as games or recreational activities, schoolwork or other tasks related to their age, especially in school-age children (AOTA, 1991; Dankert, Davies and Gavin, 2003; Kovacs, 2000; Loikith, 2005).

In school it has also been seen that performance in reading, writing and maths can be affected negatively (Cornoldi, Venneri, Marconato, Molin and Montinari, 2003; Schneck and Lemer, 1993; Solan and Ciner, 1989; Weil and Amundson, 1994) by the absence of adequate visual perceptual skills.

In the academic context, children usually work with shapes, numbers, letters or words. Subjects who have deficiencies in the visual perceptual memory abilities, may have problems to store and retrieve some visual information, involving such areas as literacy, mathematics and other subjects and activities of daily living. For example, patients with poor visual memory may have difficulty learning the alphabet and numbers in a sequential order, or difficulty remembering the shopping list or actions made in a sequence, it could also be more difficult to remember fragments of a film or a book, etc.

Poor performance in tasks of working memory has been clinically found in persons with neurodevelopmental and cognitive disorders associated with exposure to alcohol in the prenatal stage (Burden, Jacobson, Sokol and Jacobson, 2005; Carmichael-Olson, Feldman, Streissguth, Sampson and Bookstein, 1998; Jacobson and Jacobson 1999; Jacobson, Jacobson, Sokol and Ager, 1998; Kodituwakku, Handmaker, Cutler, Weathersby and Handmaker, 1995; O'Malley and Nanson, 2002; Streissguth, Barr and Sampson, 1990), with severe learning problems (Conti-Ramsden, Botting and Faragher, 2001; Gathercole and Baddeley, 1990), with Down syndrome (Broadley, MacDonald and Buckley, 1994; Jarrold, Baddeley and Hewes, 2000), with deficits in the development of the coordination (Dwyer and McKenzie, 1994; Schoemaker et al., 2001; Tsai et al., 2008), with dysfunction in sensory integration (Allison, Gabriel, Schlange and Fredrickson, 2007), with Alzheimer's disease (Viggiano et al., 2008), in children with low birth weight (Davis, Burns, Wilkerson and Steichen, 2005) and preterm infants (Brockmole, Parra, Della Sala and Logie , 2008). It has also been seen that the visual short memory in older adults may be preserved under certain conditions (Parra, Abrahams, Logie and Della Sala, 2009).

Other authors have reported deficits in visual spatial working memory and other cognitive aspects in patients with schizophrenia (Carter et al. 1996; Daban et al. 2003; Pantelis, Stuart, Nelson, Robbins and Barnes, 2001; Park and Holzman, 1992; Pukrop et al. 2003; Skelley, Goldberg, Egan, Weinberger and Gold, 2008).

Furthermore, it seems that abuse of drugs for the treatment of schizophrenia may increase depressive symptoms and interfere with metacognition, and thus the working memory (Potvin et al., 2008).

Siegert, Weatherall, Taylor and Abernethy (2008) have reported that patients with Parkinson's disease have deficits in tasks requiring visual spatial working memory.

Another study (Barrett, Kelly, Bell and King, 2008) conducted with patients with bipolar disorder has served to verify that these patients have worse outcomes and strategies in tasks that require an spatial working memory, and this result is more significant in men than in women.

On the other hand, it has been documented (Gasparini et al., 2008) that visual deficits in working memory in patients with ischemic strokes in the right hemisphere (above right choroidal artery) are associated with the inability to generate visual mental images. These same authors have argued that these deficits are the result of damage in the connections between the thalamus and the right temporal lobe, so the thalamus may have a role in the processes underlying the selective working memory.

It has also seen that changes in the blood flow of dorsal parietal lobe in patients with Williams syndrome can damage not only the representations of spatial locations, but also the visual working memory (O'Hearn, Courtney, Street and Landau, 2008).

Tseng and Chow (2000) have reported that children with low performance on the writing speed have lowest scores on visual memory and visual-sequential memory.

Kibby and Cohen (2008) have observed that children with difficulties in reading have reduced the verbal short memory but not visual short memory and the long- term memory, which indicates an involvement in the phonetic encoding.

It has been suggested that the limitation of the working memory may be one of the underlying mechanisms of dyslexia, as it can be seen in the study by Ram-Tsur, Faust and Zivotofsky (2008) for subjects with reading problems, starting tasks that require visual sequential comparisons.

As for the basic visual functions, it seems that eye movements could have an important role in the organization of visual memory, as seen in a study by Olivier and Labiale (2008) from visual memory of moving shapes work. This might suggest that people with abnormalities in eye movements may have deficits in organization of information in tasks that require visual memory.

It has also been seen that the experience is related to the binocular visual spatial memory. In a study by Cattaneo, Merabet, Bhatt and Vecchi (2008) it can be seen that subjects with congenital or monocular deprivation during early development are affected in the cortical mechanisms that relate to the visual spatial cognition, and deficits in visual spatial memory.

Often, occupational therapists and other health professionals assess and treat the problems of visual perception that occur in school-age children (Kalb and Warshowsky, 1991; Todd, 1993; Wright, Bowen and Zecker, 2000) or in people of other ages, in order to assess the presence and impact of the visual perceptual dysfunction in these patients (Brown, 2008).

Ruf-Bächtiger (1989) has suggested the enormous importance of the evaluation of some visual perceptual skills, to better understand children with visual perception

disorders and to develop more effective methods of treatment. Davis et al. (2005) have also considered that visual perception assessment should be an essential part of routine evaluation in preschool children born preterm, as early identification of visual perceptual deficits could facilitate treatment, achieving an improvement in skills or visual perceptive domains in these children with high risk.

In another report, Tsai et al. (2008) considered the assessment visual perceptual skills in children with deficits in motor coordination development has great significance for the processing and implementation of strategies for better performance on tasks of daily life.

In addition, Tseng and Chow (2000) have reported that the result of the assessment of the visual working memory sequence is one of the factors that best predict the speed of writing.

Also, Bull, Espy and Wiebe (2008) have shown that the short memory and visual spatial working memory ability predict the ability of mathematics in preschool children.

However, it is convenient that before assessing some of the visual perceptual abilities such as visual memory and visual sequential memory, closure and visual discrimination, figure-background, some of the basic visual functions, such as ocular motility are assessed, as these skills are important to conduct visual perception tests, as suggested Warren (1990).

The ability of visual sequence working memory can be assessed by some visual perceptual tests, such as:

- Continuous Visual Memory Test –CVMT– (Trahan and Larrabee, 1988)
- Children's Memory Scale –CMS– (Cohen, 1997)
- Wechsler Memory Scale, Third Edition –WMS-III– (Wechsler, 1997)

However, this skill can be assessed by some tests that assess visual perceptual different skills, including the visual sequential working memory:

- Kaufman Assessment Battery for Children –K-ABC– (Kaufman and Kaufman, 1983)
- Brief Visuospatial Memory Test, Revised Edition –BVMT-R– (Benedict, 1997)
- Detroit Tests of Learning Aptitude, Fourth Edition –DTLA-4– (Hammill, 1998)
- Woodcock-Johnson III Tests of Cognitive Abilities –WJ III COG– (Woodcock et al., 2001)

In cases where the results were below the expected values for age, it is possible to train visual perceptual skill with exercises.

In child development, are frequently used multiple strategies to carry out certain tasks effectively (Schneider, Kron, Hunnerkopf and Krajewski, 2004; Siegler, 1996 and 1999; Siegler and Stern, 1998; Sodian and Schneider, 1999). For example, Oxley and Norris (2000) have suggested that children initially use strategies, such as the distribution of attention or repetition of attempts or trials, and these strategies are associated with a specific age range, so the experience or knowledge of the child seem to be relevant to the development of this process (Bjorklund, 2005; Siegler, 1999).

Some authors (Engle, Kane and Tuholski, 1999; Ericsson and Kintsch, 1995) have proposed that a better use of strategies would improve the performance of those

tasks that require the working memory. Flavell (1970) and Guttentag (1984) have shown that performance on memory tasks improved dramatically, due in part to increased use of strategies such as association or categorization and verbal repetition of the letters submitted.

A study by Ikeda and Osaka (2007) has shown that there is an activation of brain areas associated with encoding and storage of verbal information during visual tasks of working memory, even when visual stimuli were figures of colors.

According to McNamara and Kintsch (1996), experience within a given area leads to enrich the knowledge structures and strategies for improving information retrieval.

One of the strategies used during the work of working memory is the visual verbal repetition, which helps to keep the information in the working memory and functions as a device for storing information as "cool" phonological representations in short-term storage (Atkinson and Shiffrin, 1968; Gathercole and Alloway, 2006).

Passolunghi and Cornoldi (2008) have reported that children with arithmetic difficulties and deficits in some tasks using the working memory active strategy verbalization.

The appearance of spontaneous repetitions on children's development occurs on the 7 years of age (Gathercole and Hitch, 1993) and some authors (Jarrold et al., 2000) have associated the appearance of repetition with the intellectual level of the subject.

Turley-Ames and Whitfield (2003) have suggested that verbal repetition is an easy remedy to learn, with less demand than other strategies and directs attention to relevant information. These same authors found that repetition was the preferred strategy in those subjects with low amplitude of memory.

Repetition can be a strategy that maintains long-term once trained (Broadley and MacDonald, 1993; Brown, Campione and Murphy, 1974), but requires active participation, the use of multiple training sessions over several days, systematic use of strategies taught (Broadley and MacDonald, 1993), and the subject's motivation and knowledge of how it is carrying out this procedure (Loomes, Rasmussen, Pei, Manji and Andrew, 2008).

Tsai et al. (2008), have reported that learning of visual perceptual skills can be improved through practical experience in the same way that children learn to extract relevant information from their environment in certain activities.

Some authors (Cavallini, Pagnin and Vecchi, 2003; Engle et al., 1999; Ericsson and Kintsch, 1995; Flavell, 1970; Kintsch, 1994) have suggested that memory training tasks can improve the performance of this ability in children with Down syndrome (Broadley and MacDonald, 1993; Broadley et al. 1994; Comblain, 1994 and 1996; Laws, MacDonald and Buckley, 1996), with severe learning difficulties (Bowler, 1991), with cognitive delays (Belmont and Butterfield, 1971) and neurodevelopmental or cognitive dysfunction related to alcohol exposure in the prenatal stage (Loomer et al., 2008). In addition, learning or training strategies of verbal articulation can improve performance on the skill of visual memory (Broadley and MacDonald, 1993; Brown et al. 1974; Keeney, Cannizzo and Flavell, 1967; Loomes et al., 2008; Turley-Ames and Whitfield, 2003) as the verbal repetition reinforces the maintenance of information in the stock of short-term memory, and facilitates the retrieval of information (Baddeley et al., 1998).

It is have seen that older people have some ability to learn new information and benefit from specific strategies for memory (Poon, Walsh-Sweeney and Fozard, 1980), as well as extend the efficient use of the strategies learned to other situations and tasks of everyday life (Neely and Backman, 1995). In a study by Cavallini et al. (2003) it has reported an improvement in some tests of memory after having conducted a training program for young adults and elderly by the use of strategies in some working memory visual tasks.

The exercises book presented below are recommended for use by occupational therapists, optometrists, educators, learning specialists and other health professionals, and aims to train the ability of visual sequential working memory to those who need to improve (mostly people with learning difficulties or neurological damage, both congenital and acquired), and people who want to enhance their performance in carrying out these activities, for example, athletes or students who are preparing an opposition. Memory skills that are employed in this study are of short duration, although the skills that are achieved remain to improve over time.

This book consists of 200 plates containing different sequences of figures. The first plate is a sequence that the subject must remember. Turning to the next plate, there are several sequences of images, including the sequence showed in the previous plate, the subject's task is to choose the correct sequence that matches the one presented in the previous page. The figures will rise in level of difficulty as the subject progress in the task.

## ACTIVIDADES DE ENTRENAMIENTO DE LA MEMORIA VISO-SECUENCIAL

El término de percepción visual se refiere a la capacidad que tiene el cerebro para comprender e interpretar lo que los ojos ven (Gardner, 1986; Scheiman, 1997). Junto con las funciones visuales básicas y las funciones motoras, las habilidades viso-perceptivas nos permiten llevar a cabo numerosas actividades de nuestra vida diaria (Chaikin y Downing-Baum, 1997; Erhardt y Duckman, 2005; Goodale y Milner, 2009; Jeannerod, 2006; Van Waelvelde, De Weerdt, De Cock y Smits-Engelsman, 2004).

De hecho, en nuestra vida cotidiana no percibimos un mundo formado por estímulos visuales aislados sino que nos desenvolvemos en un entorno que presenta múltiples estímulos, y en ocasiones, estos se presentan en condiciones dinámicas.

La memoria se define como la capacidad para almacenar acontecimientos pasados y poder recuperar esta información cuando sea necesaria o útil para el sujeto. Gracias a la memoria sabemos quiénes somos y nuestra vida adquiere sentido de continuidad (Ruiz-Vargas, 1995).

Algunos investigadores (Graf y Schacter, 1985; Schacter, 1985) han propuesto que adquirimos información sobre nosotros mismos y sobre el entorno a través de experiencias que registramos, almacenamos y recuperamos por medio de diferentes *sistema*s de memoria, entendiendo que un sistema de memoria es un conjunto correlacionado de procesos (Tulving, 1985).

Si se tiene en cuenta la duración temporal de los procesos de memoria, éstos se pueden dividir en memoria sensorial, memoria operativa o a corto plazo y memoria a largo plazo.

La memoria sensorial (Sperling, 1960) tiene una duración de tiempo muy breve, en torno a unos milisegundos, y permite llegar a cabo con éxito los distintos procesos que tienen lugar durante la percepción inicial de los estímulos.

La memoria operativa, a corto plazo o primaria (James, 1890) tiene una duración mayor, prologándose hasta 10 ó 15 segundos; su función es almacenar y recuperar la información de algo que acaba de suceder.

La memoria a largo plazo (MLP) puede durar semanas, meses o, incluso toda la vida; en ella se almacena información de distinta naturaleza, como recuerdos vividos, imágenes, conceptos; se considera la “base de datos” en la que se consolida la información, que proviene de la memoria a corto plazo, para poder posteriormente hacer uso de ella. Tanto la memoria procedimental, como la memoria declarativa, son sub-sistemas de memoria dentro de la MLP.

La memoria procedimental almacena información acerca de sensaciones, procedimientos y estrategias que permiten interactuar con el entorno, de forma que su “puesta en marcha” tiene lugar de manera inconsciente o automática (Tulving, 1987). Mientras que la memoria declarativa almacena información sobre hechos, personas, lugares o cosas que se recuerdan mediante un refuerzo consciente (Tulving, 1987).

Otros dos sistemas de memoria relacionados con la MLP son la memoria semántica (Schacter y Tulving, 1994), que almacena conocimientos acerca de los significados de las palabras, y la memoria episódica (Schacter y Tulving, 1994), que representa eventos o sucesos que reflejan detalles de la situación vivida, y no solamente del significado.

Sin embargo, de todos los sistemas de memoria comentados hasta ahora, la memoria operativa (MO) o a corto plazo (MCP) permite mantener disponible la información relevante para que pueda llevarse a cabo alguna conducta.

A veces, se utilizan indistintamente los términos MCP y memoria de trabajo (MT). Sin embargo, ambos términos connotan aspectos diferentes. Si bien, la MCP se refiere al almacenamiento de la información a corto plazo, el concepto de MT englobaría los mismos procesos de almacenamiento, junto con su manipulación temporal para poder planificar y guiar nuestra conducta (Baddeley y Della Sala, 1998; Baddeley y Hitch, 1974); por lo tanto, la MT interviene en tareas cognitivas de orden superior (Gathercole y Alloway, 2006), como la comprensión del lenguaje hablado y escrito (Daneman y Merikle, 1996), la comprensión aritmética (Adams y Hitch, 1997), el razonamiento, el seguimiento de instrucciones (Engle, Carullo y Collins, 1991) y la resolución de problemas (Baddeley, 1986).

Gran parte de la información que adquirimos en la vida cotidiana se lleva a cabo visualmente, registrando, almacenando y recuperando esta información a través de un sistema de memoria visual. Esta información visual pueden ser números, letras, palabras, textos, figuras, objetos, rostros, paisajes, acciones, etc. Cuando se presentan varios estímulos visuales de manera individual, pero entre ellos hay un lapso de tiempo, o cuando se presentan todos ellos en conjunto para poder memorizarlos, se dice que la tarea requiere una demanda de memoria viso-secuencial.

Tanto la memoria visual y la memoria viso-secuencial son una parte importante del procesamiento de la información visual y participan en gran número de actividades académicas y de la vida diaria de las personas. Además, son muy importantes para los procesos de aprendizaje, debido a que más del 80% de estos procesos se adquieren visualmente.

A menudo los pedagogos y educadores utilizan la memoria visual como recurso educativo y utilizan cada vez más los métodos audiovisuales para facilitar la introducción de contenidos con el objetivo de evitar la fatiga y el aburrimiento de los alumnos. También está ampliamente difundida la utilización de dibujos, figuras, esquemas y fotos en los libros de texto. Otro recurso educativo muy extendido consiste en destacar palabras, frases o conceptos en algún color para facilitar su recuerdo (en este caso el recuerdo visual sería el color asociado a la frase o palabra). Por otra parte, la memoria visual es una habilidad que también se demanda en el ámbito de las nuevas tecnologías: la televisión, Internet, etc.

En un estudio de Agam y cols. (2009) se ha visto que existe actividad neuronal en áreas visuales durante determinadas tareas de MCP, por lo que las áreas visuales contribuyen al almacenamiento temporal de la información visual para su uso en tareas que se realizarán posteriormente.

La implicación de la MT en este tipo de funciones cognitivas, que son esenciales para alcanzar un rendimiento óptimo en el ámbito académico, laboral o deportivo, hace que su estudio sea de interés para disciplinas aplicadas como la Optometría, la Terapia Ocupacional o la Psicología Educativa.

En la literatura existe cierto consenso en que la capacidad de control de la atención es uno de los factores determinantes en el rendimiento de un individuo al realizar tareas relacionadas con la MT (Engle, 2002; Kane, Bleckley, Conway y Engle, 2001).

También se ha visto que la capacidad para almacenar la información en la MT es limitada (Baddeley, 2003; Engle, Cantor y Carullo, 1992; Luck y Vogel, 1997; Miller, 1956). Los resultados que aporta la literatura en cuanto a la capacidad de la MT son muy variados, ya que dependen en gran parte del contexto en el cual se desarrollan los estudios, así como de los modelos e instrumentos de medición utilizados (Ollis, Button y Fairweather, 2005; Towse, Hitch y Hutton, 2000). Además, las tareas de MT se pueden hacer más complejas añadiendo estímulos que provoquen interferencias durante el proceso de memorización (Costa, Alario y Caramazza, 2005; Goolkasian y Foos, 2005).

Otro aspecto que afecta a la variabilidad de los resultados es el tiempo entre estímulos utilizado durante la realización de la prueba (De Fockert, Rees, Frith y Lavie, 2001; Hashimoto y cols., 2006).

Miller (1956) estimó que la amplitud de memoria en tareas de MT visual, cuando se presenta una serie de estímulos, es de unos 7 elementos o ítems en jóvenes adultos, mientras que Luck y Vogel (1997) sugirieron que la capacidad de la MT está limitada por el número de ítems presentados (en torno a cuatro), y es independiente del número de bits o carga de información que contenga cada uno de ellos. No obstante, algunos autores han estimado que la capacidad memoria en tareas de MT visual es dependiente de la carga de información de los estímulos presentados, pudiendo variar entre cuatro y seis ítems (Alvarez y Cavanagh, 2004; Jiang, Olson y Chun, 2000; Luck y Vogel, 1997; Pashler, 1988; Simons, 1996).

También se cree que la amplitud de memoria en tareas de MT visual depende del contenido léxico y semántico de los estímulos presentados (Hulme, Roodenrys, Brown y Mercer, 1995).

Es posible que la diferencia de sexo también sea un factor determinante en la capacidad de la MT. En un estudio reciente llevado a cabo por Harness, Jacot, Scherf, White y Warnick (2008) se ha visto que las mujeres son capaces de reproducir más cantidad de estímulos visuales que los hombres en tareas de MT visual, aunque según estos autores deberían realizarse otros estudios que valoren este aspecto con más detalle, pues los resultados son inconsistentes con los obtenidos en algunos estudios previos (Ionescu, 2000 y 2004; Kail y Siegel, 1978).

Por otra parte, el proceso de codificación, almacenamiento y recuperación que se da en tareas de MT visual puede ser alterado cuando se aumenta la dificultad de la tarea (Cowan, Johnson y Saults, 2005; Goh y Pisoni, 2003; Goolkasian y Foos, 2005; Tremblay, Nicholls, Parmentier y Jones, 2005). Sin embargo, no siempre existe una relación sencilla entre el aumento de la dificultad de la tarea y la capacidad de retención de la información. Por ejemplo, Oberauer y Suss (2000) informaron que los sujetos que eran capaces de retener un número mayor de ítems también eran capaces de utilizar estrategias más complejas cuando se aumentaba la dificultad de la tarea, por eso se ha visto que algunos objetos complejos como rostros, tardan más en desvanecerse en la memoria que otros estímulos visuales más sencillos, como la orientación de líneas (Jiang, Shim y Makovski, 2008).

A pesar de nuestra capacidad limitada para memorizar, la mayoría de los objetos se componen de múltiples atributos o características; podemos almacenar voluntariamente un único atributo de un objeto sin necesidad de almacenar la totalidad de sus restantes características, controlando y seleccionando qué atributos se almacenan en la MT visual (Woodman y Vogel, 2008).

Se ha sugerido (Ericsson y Kintsch, 1995; Just y Carpenter, 1992) que el conocimiento y las habilidades o experiencias adquiridas con el tiempo (a largo plazo), determinan la capacidad de almacenamiento, manipulación y recuperación de la información en la MT.

Basándose en las consideraciones anteriores, Cowan (1995) sugirió que la MT no sería una entidad independiente, sino que formaría parte de la MLP. En su modelo de memoria, las representaciones en la MT serían un subconjunto de las representaciones activas de la MLP. De hecho, los resultados obtenidos por Chi (1978) unos años antes ya ponían de manifiesto que los niños pequeños expertos en el juego de ajedrez eran capaces de recordar un mayor número de posiciones de las piezas que adultos inexpertos en este juego, aunque su capacidad para memorizar una serie de dígitos fuera menor que la de los adultos.

De la misma manera, los estudios de Bower (1972) también muestran la relación entre la capacidad de MT y MLP. En sus experimentos para valorar la amplitud de memoria mediante la presentación oral y visual con series de letras agrupadas y separadas por pausas de duración temporal, se vio que los resultados eran más favorables en aquellos sujetos en los que las series de letras agrupadas correspondían a siglas conocidas previamente por los sujetos.

Gran parte de la información codificada se almacena en la MLP, y de esta manera se asocia la información actual disponible con la información del pasado mediante procesos de recuperación (Ericsson y Delaney, 1999; Ericsson y Kintsch, 1995). Es decir, que utilizando el conocimiento previo, almacenado en la MLP, la nueva información entrante puede ser fácilmente recuperada activando asociaciones con algunos elementos codificados en la MLP.

Las habilidades viso-perceptivas del niño no están en el mismo nivel que las del adulto, pero su percepción del mundo sigue siendo buena (Arterberry, 2008). Sin embargo, cualquier factor que interfiera en la capacidad del niño de explorar su entorno puede impedir el proceso de aprendizaje viso-perceptivo (Tsai, Wilson y Wu, 2008), afectando negativamente a la capacidad para llevar a cabo actividades de la vida diaria, como juegos o actividades recreativas, trabajos escolares u otras tareas relacionadas con su edad, especialmente en niños en edad escolar (AOTA, 1991; Dankert, Davies y Gavin, 2003; Kovacs, 2000; Loikith, 2005).

Además, se ha visto que en el ámbito escolar el rendimiento de la lectura, la escritura y las matemáticas puede verse afectado negativamente (Cornoldi, Venneri, Marconato, Molin y Montinari, 2003; Schneck y Lemer, 1993; Solan y Ciner, 1989; Weil y Amundson, 1994) por la ausencia de unas habilidades viso-perceptivas adecuadas.

En el contexto académico, habitualmente se trabaja con figuras, números, letras, o con palabras. Los sujetos que tienen deficiencias en la habilidad viso-perceptiva de la memoria visual pueden tener problemas para almacenar y recuperar cierta información visual, implicando a áreas como la lecto-escritura, las matemáticas u otras materias y actividades de la vida cotidiana. Por ejemplo, los pacientes con poca memoria visual podrían tener dificultades para aprender el abecedario y los números en un orden consecutivo, o dificultades para recordar la lista de la compra o acciones que se han realizado en una secuencia determinada; también podría ser más difícil recordar fragmentos de una película o de un libro, etc.

El bajo rendimiento en las tareas de MT, algunas de ellas visuales, ha sido valorado clínicamente en personas con trastornos de neurodesarrollo y cognitivos relacionados con la exposición de alcohol en la etapa prenatal (Burden, Jacobson,

Sokol y Jacobson, 2005; Carmichael-Olson, Feldman, Streissguth, Sampson y Bookstein, 1998; Jacobson y Jacobson, 1999; Jacobson, Jacobson, Sokol y Ager, 1998; Kodituwakku, Handmaker, Cutler, Weathersby y Handmaker, 1995; O'Malley y Nanson, 2002; Streissguth, Barr y Sampson, 1990), con problemas severos de aprendizaje (Conti-Ramsden, Botting y Faragher, 2001; Gathercole y Baddeley, 1990), con el Síndrome de Down (Broadley, MacDonald y Buckley, 1994; Jarrold, Baddeley y Hewes, 2000), con déficits en el desarrollo de la coordinación –DCD– (Dwyer y McKenzie, 1994 ; Schoemaker y cols., 2001; Tsai y cols., 2008), con disfunciones en la integración sensorial (Allison, Gabriel, Schlange y Fredrickson, 2007), con la enfermedad de Alzheimer (Viggiano y cols., 2008), en niños con bajo peso al nacer (Davis, Burns, Wilkerson y Steichen, 2005) y en personas de edad avanzada (Brockmole, Parra, Della Sala y Logie, 2008). Aunque también se ha visto que la MCP visual de los adultos de edad avanzada puede ser conservada bajo determinadas condiciones (Parra, Abrahams, Logie y Della Sala, 2009).

Otros autores han informado de déficits en la MT viso-espacial y de otros aspectos cognitivos en pacientes con esquizofrenia (Carter y cols., 1996; Daban y cols., 2003; Pantelis, Stuart, Nelson, Robbins y Barnes, 2001; Park y Holzman, 1992; Pukrop y cols., 2003; Skelley, Goldberg, Egan, Weinberger y Gold, 2008).

Kim, Namgoong y Youn (2008), han sugerido que los déficits de la MT visual en este tipo de pacientes están relacionados a su vez con los déficits de organización.

Además, se ha visto que el abuso de fármacos para el tratamiento de la esquizofrenia puede incrementar los síntomas depresivos e interferir en la metacognición, y por tanto en la MT (Potvin y cols., 2008).

Siegert, Weatherall, Taylor y Abernethy (2008) han informado que los pacientes con la enfermedad de Parkinson tienen déficits en tareas que requieren MT viso-espacial.

Otro estudio (Barrett, Kelly, Bell y King, 2008) llevado a cabo con pacientes con trastornos bipolares, ha servido para comprobar que este tipo de pacientes tiene peores estrategias y resultados en aquellas tareas que requieren la MT espacial, siendo más significativo en hombres que en mujeres.

Por otro lado, se ha documentado (Gasparini y cols., 2008) que los déficits en la MT visual en pacientes con accidentes cerebrovasculares isquémicos del hemisferio derecho (arteria coroidea anterior derecha) están asociados a la incapacidad para generar representaciones visuales mentales o visualizar imágenes. Estos mismos autores han argumentado que estos déficits son el resultado del daño en las conexiones entre el tálamo derecho y el lóbulo temporal derecho, por lo que el tálamo podría tener una función en los procesos selectivos que subyacen en la MT.

También se ha visto que las alteraciones en el flujo del lóbulo parieto-dorsal en pacientes con el Síndrome de Williams puede dañar no sólo las representaciones de ubicaciones espaciales, sino además la MT visual (O'Hearn, Courtney, Street y Landau, 2008).

Tseng y Chow (2000) han informado que niños con bajo rendimiento en la velocidad de escritura tienen resultados más bajos en algunas tareas de memoria visual y memoria viso-secuencial.

Kibby y Cohen (2008) han observado que niños con dificultades en el ámbito de la lectura tienen reducida la MCP verbal, pero no la MCP visual, el ejecutivo central y la MLP, lo que indica una afectación en la codificación fonética.

Se ha sugerido que la limitación de la MT podría ser uno de los mecanismos subyacentes de la dislexia, tal y como se ha visto en el estudio realizado por Ram-Tsur, Faust y Zivotofsky (2008) a sujetos con problemas de lectura, a partir de tareas que requieren comparaciones viso-secuenciales.

En cuanto a las funciones básicas visuales, se ha visto que los movimientos oculares podrían tener un importante papel en la organización de la memoria visual, tal y como se ha visto en un estudio realizado por Olivier y Labiale (2008) a partir de tareas de memoria visual con movimiento de formas. Esto podría hacer pensar que personas con alteraciones en los movimientos oculares pudieran tener déficits en la organización de la información en aquellas tareas que demandan la memoria visual.

También se ha visto que la experiencia binocular está relacionada con la memoria viso-espacial. En un estudio de Cattaneo, Merabet, Bhatt y Vecchi (2008) se ha visto que los sujetos con deprivación monocular congénita o en edades tempranas tienen afectación en el desarrollo de los mecanismos corticales que se relacionan con la cognición viso-espacial, y déficits en la memoria viso-espacial.

Con frecuencia, los terapeutas ocupacionales y otros profesionales de la salud evalúan y tratan los problemas de percepción visual que se producen en niños en edad escolar (Kalb y Warshowsky, 1991; Todd, 1993; Wright, Bowen y Zecker, 2000) o en personas de otras edades, con el fin de valorar la presencia y el impacto de las disfunciones viso-perceptivas en este tipo de pacientes (Brown, 2008).

Ruf-Bächtiger (1989) ha sugerido la enorme importancia que tiene la evaluación de algunas habilidades viso-perceptivas, para entender mejor a los niños con trastornos de percepción visual y poder desarrollar de manera más eficaz los métodos de tratamiento. Davis y cols. (2005) también han considerado que el examen viso-perceptivo debe ser una parte imprescindible de la evaluación rutinaria en niños de edad preescolar nacidos prematuramente, ya que la identificación temprana de los déficits viso-perceptivos podrían facilitar su tratamiento, logrando una mejora en las habilidades o dominios viso-perceptivos en estos niños con alto riesgo.

En otro informe, Tsai y cols. (2008) han considerado que la valoración del rendimiento viso-perceptivo en niños con déficits en el desarrollo de la coordinación motora –DCD–, tiene una gran importancia de cara al tratamiento y a la aplicación de estrategias para un mejor rendimiento en las tareas de su vida diaria.

Además, Tseng y Chow (2000) han informado que la evaluación de la MT viso-secuencial resulta ser uno de los factores que mejor predicen la velocidad de escritura.

También, Bull, Espy y Wiebe (2008) han revelado que la MCP y la MT viso-espacial predicen bien la capacidad para la habilidad de las matemáticas en niños preescolares.

No obstante, es conveniente que antes de evaluar algunas de las habilidades viso-perceptivas, como la memoria visual y memoria viso-secuencial, el cierre visual y la discriminación de la figura-fondo, sean valoradas algunas de las funciones visuales básicas, como la oculomotricidad, ya que estas funciones son importantes para llevar a cabo las pruebas de éste tipo de habilidades perceptivas, tal y como ha sugerido Warren (1990).

La habilidad de la MT viso-secuencial se puede evaluar mediante algunas pruebas viso-perceptivas específicas, como:

- Continuous Visual Memory Test –CVMT– (Trahan y Larrabee, 1988)
- Children's Memory Scale –CMS– (Cohen, 1997);
- Wechsler Memory Scale, Third Edition –WMS-III– (Wechsler, 1997)

Sin embargo, esta habilidad también se puede evaluar mediante algunas pruebas viso-perceptivas que valoran distintas habilidades, entre ellas la MT viso-secuencial:

- Kaufman Assessment Battery for Children –K-ABC– (Kaufman y Kaufman, 1983)
- Brief Visuospatial Memory Test, Revised Edition –BVMT-R– (Benedict, 1997)
- Detroit Tests of Learning Aptitude, Fourth Edition –DTLA-4– (Hammill, 1998)
- Woodcock-Johnson III Tests of Cognitive Abilities –WJ III COG– (Woodcock y cols., 2001)

Recientemente, se ha visto que un nuevo test computerizado de MT visual, The computerized object and abstract designs –COAD– (Price, 2008), basado en el buffer episódico del modelo de Baddeley, es más sensible en pacientes con lesiones cerebrales, que otros tests estandarizados de MT visual que existen en la actualidad en uso clínico. Por ello, los autores recomiendan su utilidad para la detección precoz de determinadas enfermedades neurológicas degenerativas, así como para la identificación de déficits en la MT visual y en neuro-rehabilitación.

Una vez que se haya administrado una o varias de estas pruebas, se puede determinar si esta habilidad viso-perceptiva se corresponde o no con el nivel de rendimiento esperado para la edad cronológica del sujeto. En aquellos casos en los que los resultados obtenidos estuvieran por debajo de los valores esperados para su edad, es posible entrenar esta habilidad viso-perceptiva mediante ejercicios como los que aparecen en el presente cuaderno de actividades.

En el desarrollo del niño, es frecuente el uso de múltiples estrategias para poder llevar a cabo determinadas tareas de manera eficaz (Schneider, Kron, Hunnerkopf y Krajewski, 2004; Siegler, 1996 y 1999; Siegler y Stern, 1998; Sodian y Schneider, 1999). Por ejemplo, Oxley y Norris (2000) han sugerido que el niño inicialmente usa estrategias, como la distribución de la atención o la repetición de intentos o ensayos, y que dichas estrategias se asocian con un determinado rango de edad, por lo que la experiencia o el conocimiento del niño parecen ser relevantes para el desarrollo de este proceso (Siegler, 1999; Bjorklund, 2005).

Algunos autores (Engle, Kane y Tuholski, 1999; Ericsson y Kintsch, 1995) han propuesto que un mejor uso de las estrategias debería mejorar el rendimiento de aquellas tareas que requieren la MT. Flavell (1970) y Guttentag (1984) han demostrado que el rendimiento en tareas de memoria mejora de forma espectacular, debido en parte al incremento del uso de estrategias utilizadas, como la asociación o categorización y el repaso verbal de las letras presentadas.

Un estudio de Ikeda y Osaka (2007) ha puesto de manifiesto que existe una activación de las áreas cerebrales relacionadas con la codificación y almacenamiento de la información verbal durante tareas de MT visual, aún cuando los estímulos visuales presentados correspondían a figuras de colores. Estos autores han sugerido que la posible estrategia verbal "más claro" o "más oscuro" utilizada por los sujetos

para memorizar mejor los colores de las figuras, podrían haber contribuido de una manera positiva al almacenamiento de la información en la MT visual.

Según McNamara y Kintsch (1996), la experiencia dentro de un ámbito determinado lleva a enriquecer las estructuras del conocimiento, y a la mejora de estrategias de recuperación de la información.

Una de las estrategias utilizadas durante las tareas de MT visual es la repetición verbal, que ayuda a mantener la información en la MT y funciona como un dispositivo de almacenamiento de la información, ya que "refresca" las representaciones fonológicas en el almacén a corto plazo (Atkinson y Shiffrin, 1968; Gathercole y Alloway, 2006).

Passolunghi y Cornoldi (2008) han informado que niños con dificultades aritméticas y déficits en algunas tareas de MT activa utilizan la estrategia de verbalización.

La aparición de las repeticiones espontáneas en el desarrollo del niño se produce sobre los 7 años de edad (Gathercole y Hitch, 1993) y algunos autores (Jarrold y cols., 2000) han asociado la aparición de la repetición con el nivel intelectual del sujeto.

Turley-Ames y Whitfield (2003) han propuesto que la repetición verbal es un recurso fácil de aprender, con menos demanda que otras estrategias y dirige la atención a la información relevante. Estos mismos autores encontraron que la repetición fue la estrategia preferida en aquellos sujetos con baja amplitud de memoria.

La repetición puede ser una estrategia que se mantiene a largo plazo una vez entrenada (Broadley y MacDonald, 1993; Brown, Campione y Murphy, 1974), pero requiere la participación activa, el empleo de múltiples sesiones de entrenamiento durante varios días, el uso sistemático de las estrategias enseñadas (Broadley y MacDonald, 1993), así como la motivación del sujeto y el conocimiento de cómo se está llevando a cabo este procedimiento (Loomes, Rasmussen, Pei, Manji y Andrew, 2008).

Tsai y cols. (2008), han informado de que el aprendizaje de las habilidades viso-perceptivas pueden mejorarse mediante la experiencia práctica, de la misma manera que un niño aprende a extraer la información relevante de su entorno en determinadas actividades cotidianas.

Algunos autores (Cavallini, Pagnin y Vecchi, 2003; Engle y cols., 1999; Ericsson y Kintsch, 1995; Flavell, 1970; Kintsch, 1994) han sugerido que el entrenamiento con tareas de memoria puede mejorar el rendimiento de esta habilidad en niños con síndrome de Down (Broadley y MacDonald, 1993; Broadley y cols., 1994; Comblain, 1994 y 1996; Laws, MacDonald y Buckley, 1996), con dificultades severas de aprendizaje (Bowler, 1991), con retrasos cognitivos (Belmont y Butterfield, 1971) y con disfunciones de neurodesarrollo o cognitivas relacionadas con la exposición de alcohol en la etapa prenatal (Loomes y cols., 2008). Además, el aprendizaje o entrenamiento de estrategias de articulación verbal puede mejorar el rendimiento de la habilidad de memoria visual (Broadley y MacDonald, 1993; Brown y cols., 1974; Keeney, Cannizzo y Flavell, 1967; Loomes y cols., 2008; Turley-Ames y Whitfield, 2003) ya que la repetición verbal refuerza el mantenimiento de la información presentada en el almacén de la memoria a corto plazo, y facilita la posterior recuperación de la información (Baddeley y cols., 1998).

Se ha visto que las personas de edad avanzada tienen cierta capacidad para aprender nueva información, y beneficiarse con estrategias específicas para la memoria (Poon, Walsh-Sweeney y Fozard, 1980), así como de extender el uso eficiente de las estrategias aprendidas a otras situaciones y tareas de su vida cotidiana (Neely y Backman, 1995). En un estudio de Cavallini y cols. (2003) se ha informado sobre la mejora en algunas pruebas de memoria después de haber llevado a cabo un entrenamiento a personas jóvenes adultas y de edad avanzada mediante el uso de estrategias en algunas tareas de MT visual.

El libro de ejercicios que presentamos a continuación está recomendado para ser utilizado por terapeutas ocupacionales, optometristas, educadores, especialistas del aprendizaje y otros profesionales de la salud, y pretende entrenar la habilidad de la MT viso-secuencial a aquellas personas que la necesiten mejorar (principalmente personas con dificultades de aprendizaje o con daños neurológicos, tanto congénitos, como adquiridos), y a personas que quieran aumentar su rendimiento al realizar estas actividades, por ejemplo, deportistas o estudiantes que se estén preparando una oposición. Las habilidades de memoria que se trabajan en este cuaderno son de corta duración (es decir, se trabaja la memoria de trabajo), aunque las habilidades que se consiguen mejorar permanecen a lo largo del tiempo.

Este cuaderno está compuesto por 200 láminas que contienen distintas secuencias de figuras. En la primera lámina aparece una secuencia que el sujeto debe recordar. Al pasar a la siguiente lámina aparecen varias secuencias de figuras, entre ellas la que el sujeto ha recordado en la página anterior; la tarea del sujeto consiste en elegir la secuencia correcta que coincide con la presentada en la página anterior. A continuación, se pasa a la siguiente página, donde aparece un nuevo ítem, y así sucesivamente hasta completar los 100 estímulos. Las figuras van subiendo en nivel de dificultad conforme se avanza en la tarea.

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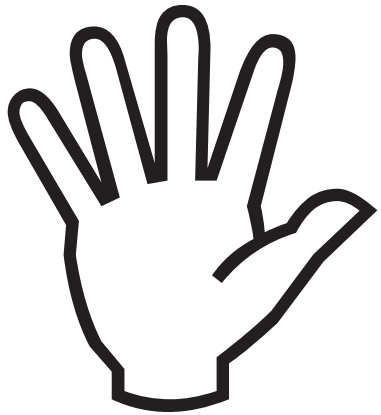
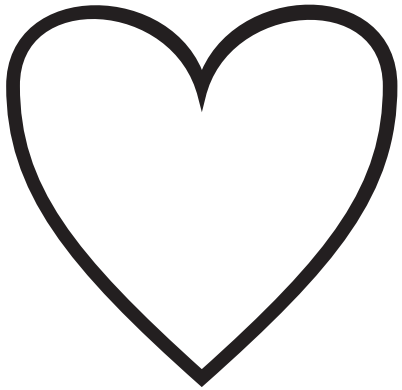
# ADMINISTRATION

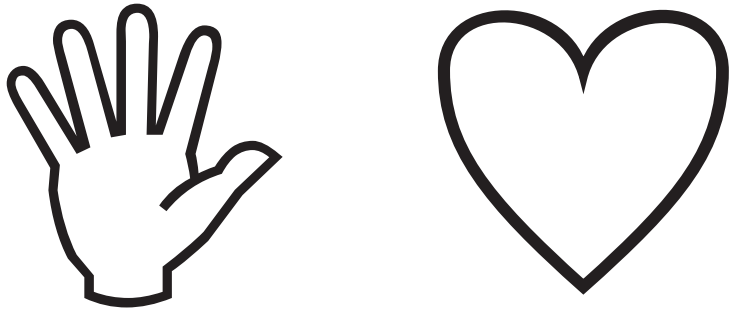
## NORMAS DE APLICACIÓN

**In the following pages, a sequence of figures is presented. You must to memorize the sequence and then to find the IDENTICAL sequence among the different responses that are displayed on the next plate. Please, do the same in other plates. There is only one correct answer in each plate.**

A continuación, aparece una secuencia de varias figuras. Trate de memorizar la secuencia completa y después busque otra TOTALMENTE IDÉNTICA entre las diferentes respuestas que se muestran en la lámina siguiente. Haga lo mismo en el resto de láminas. Solamente existe una única respuesta correcta para cada lámina.







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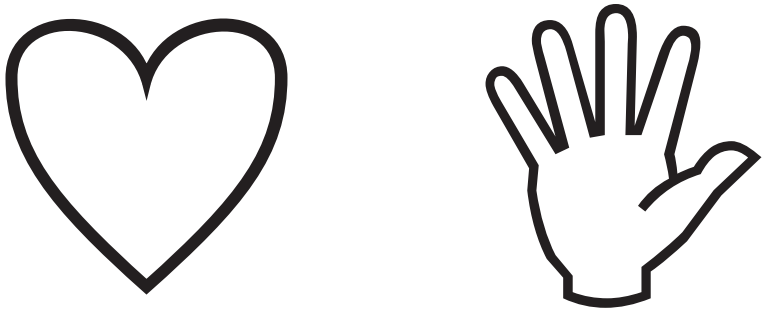

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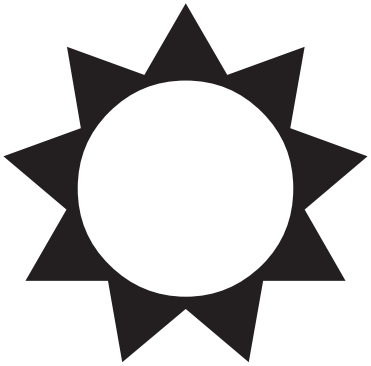

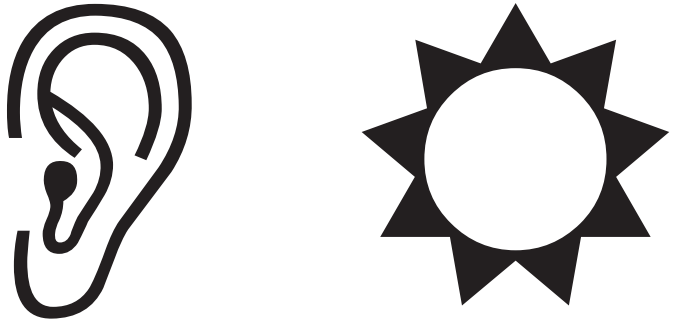

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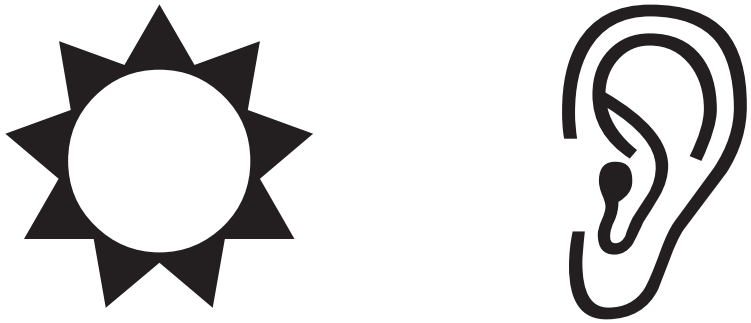

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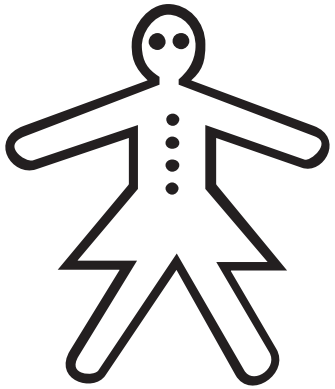

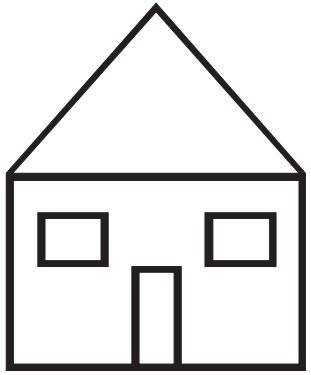

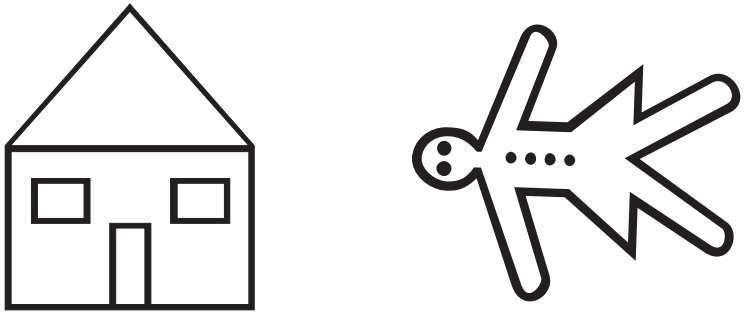

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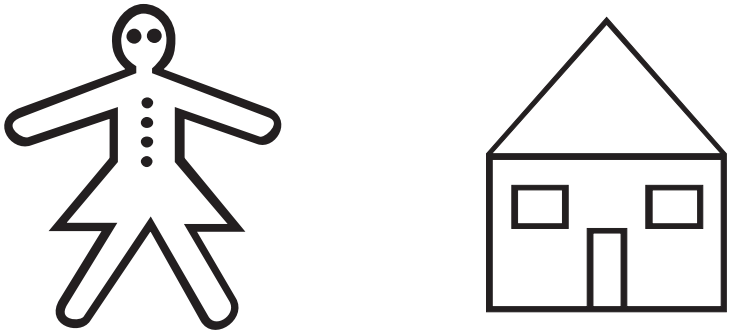

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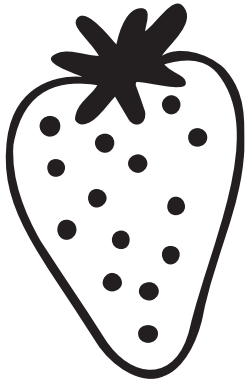

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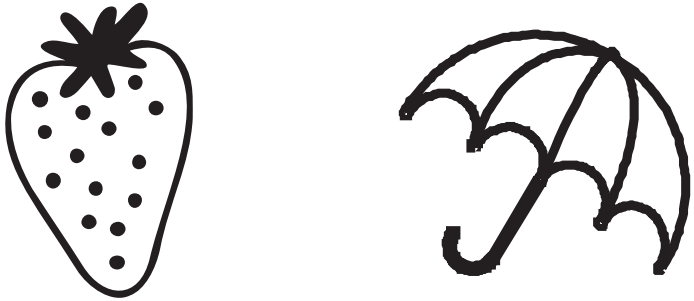

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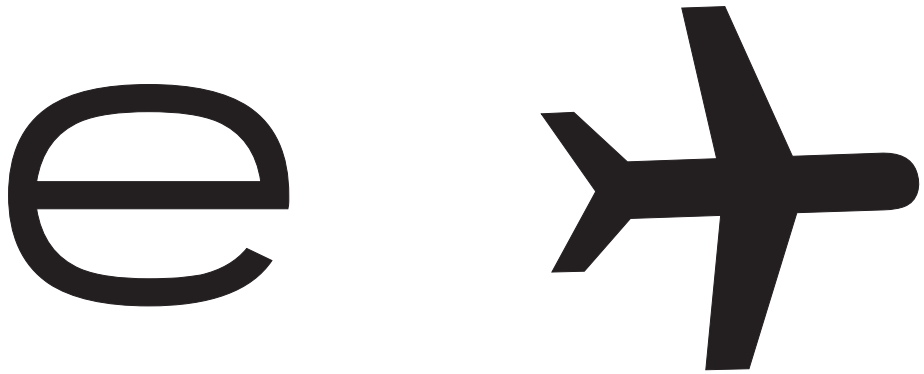

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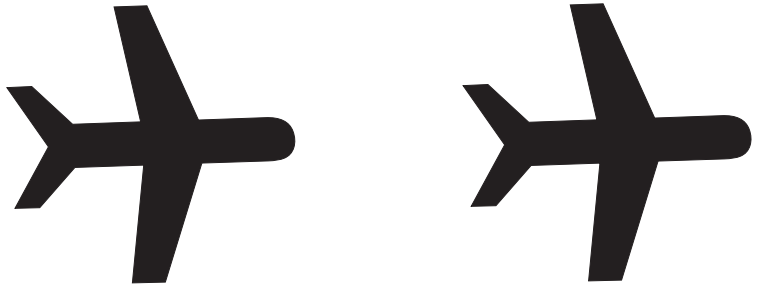

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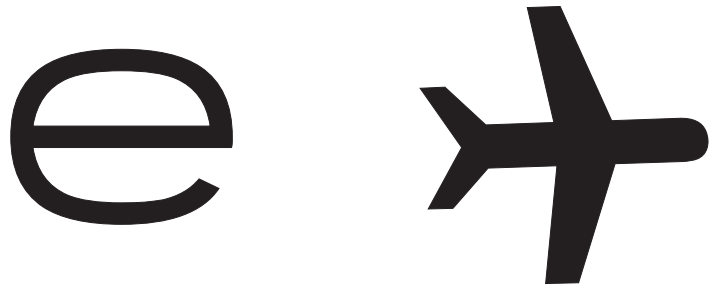

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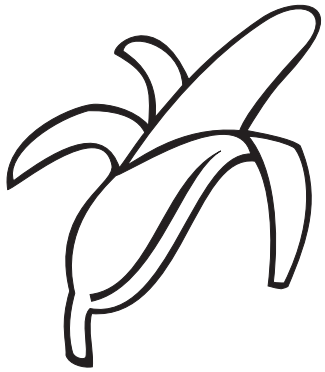

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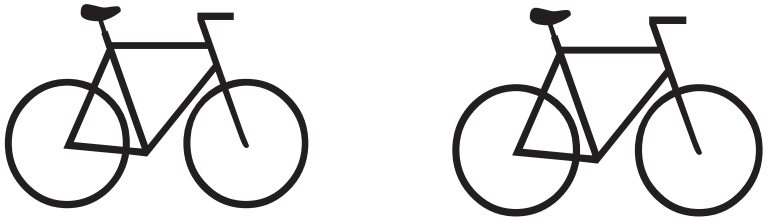

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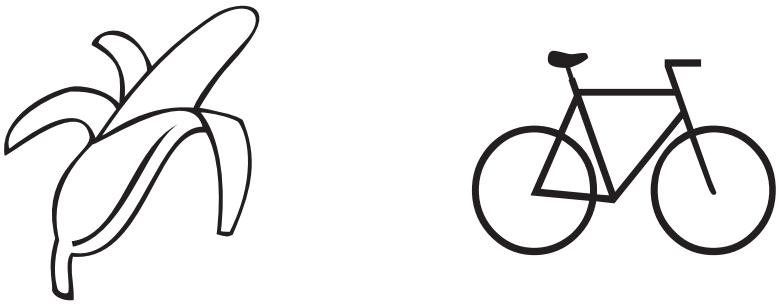

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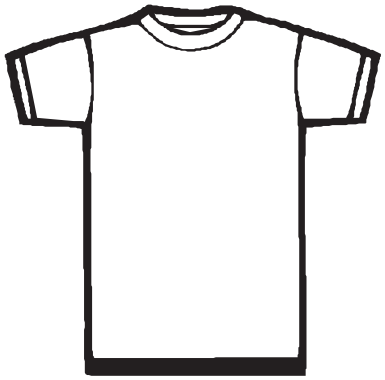

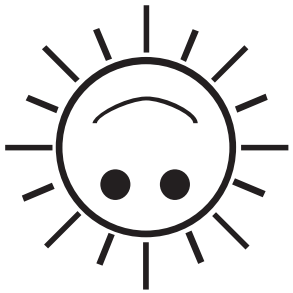

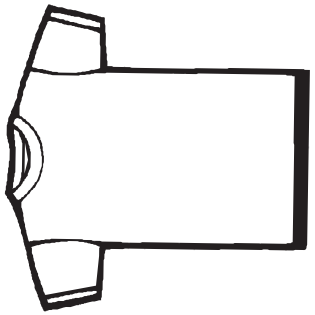

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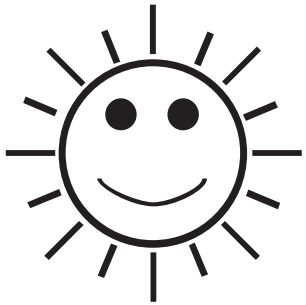

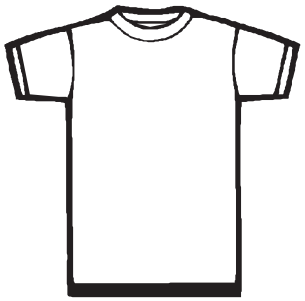

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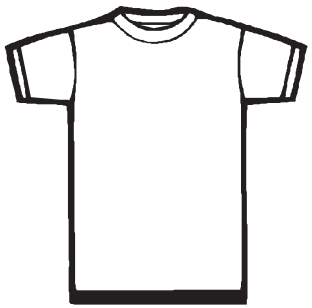

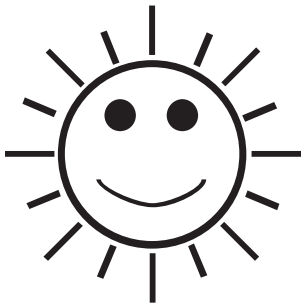

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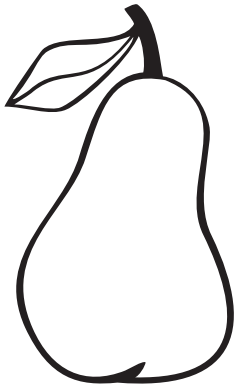

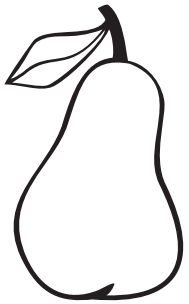

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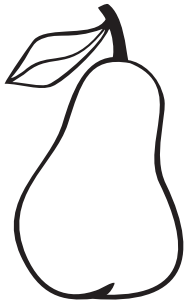

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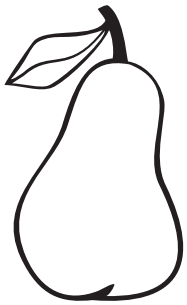

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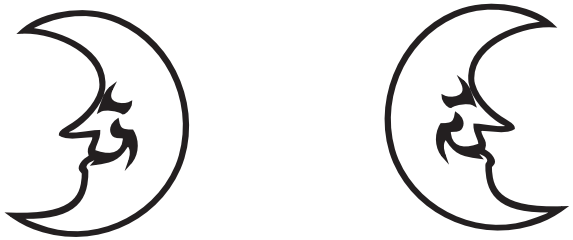

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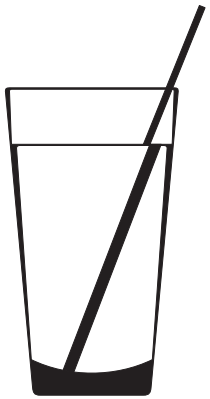

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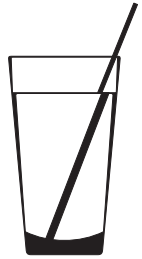

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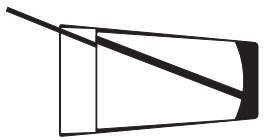

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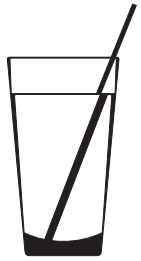

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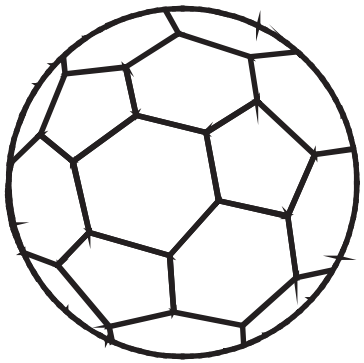

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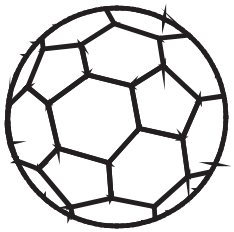

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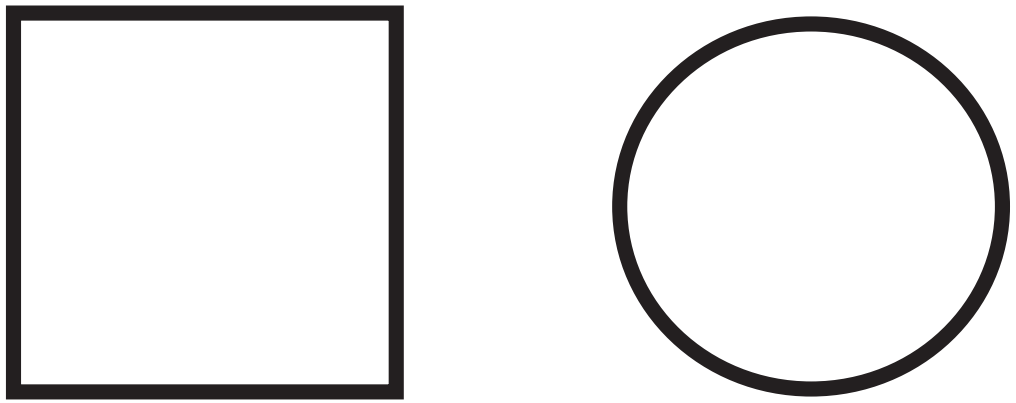

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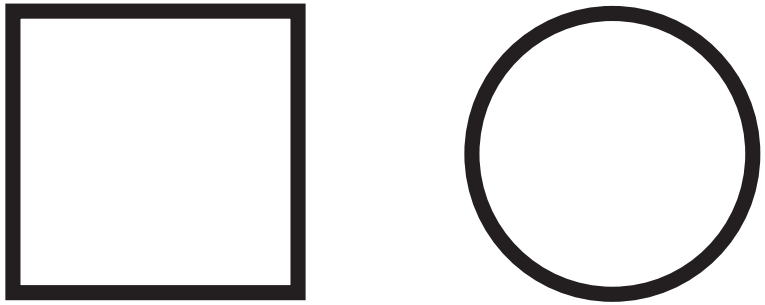

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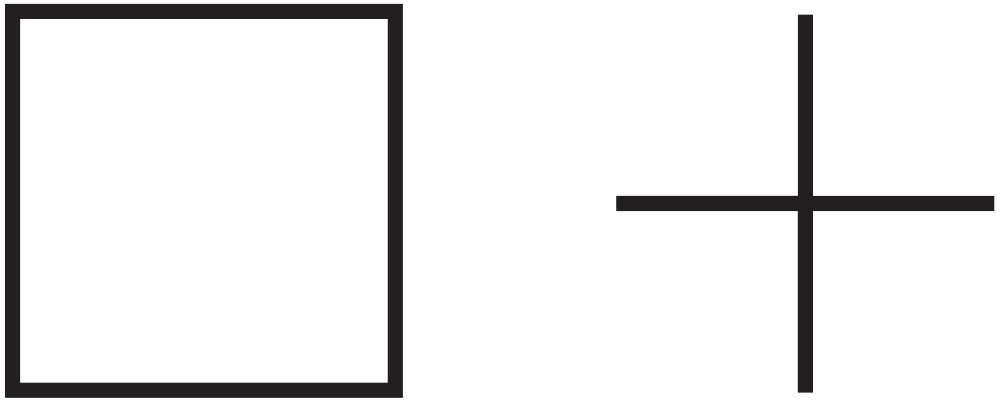

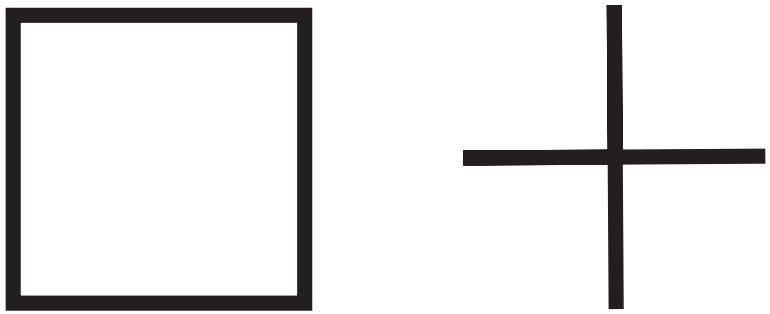

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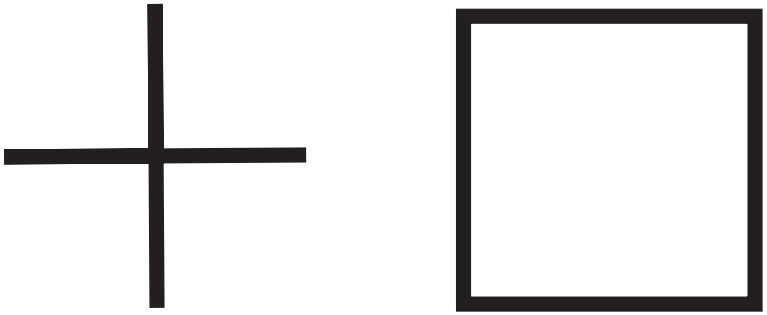

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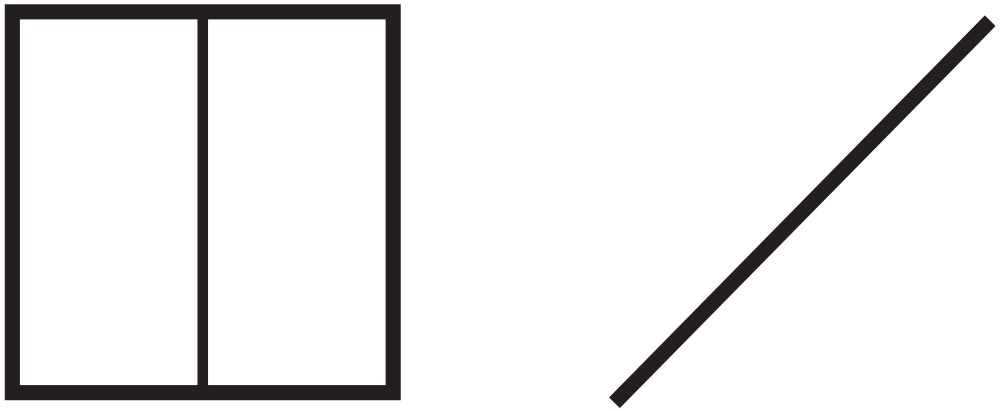

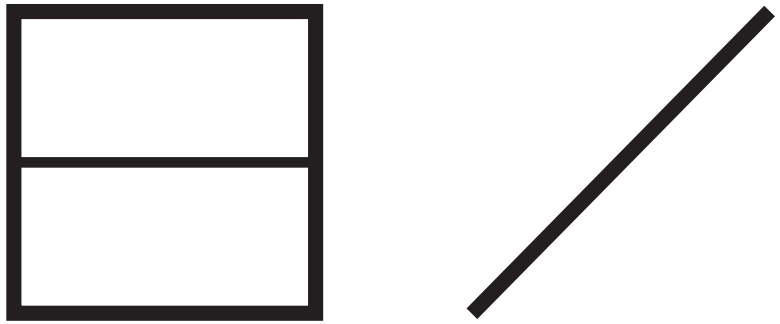

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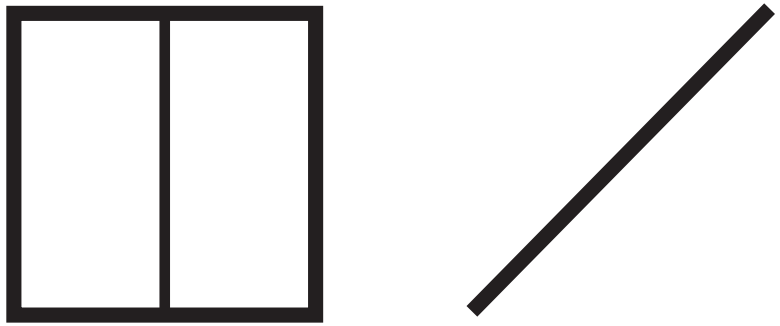

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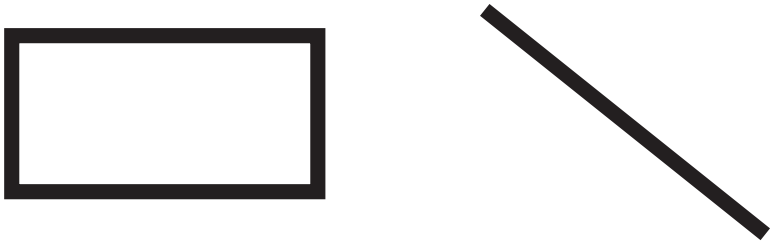

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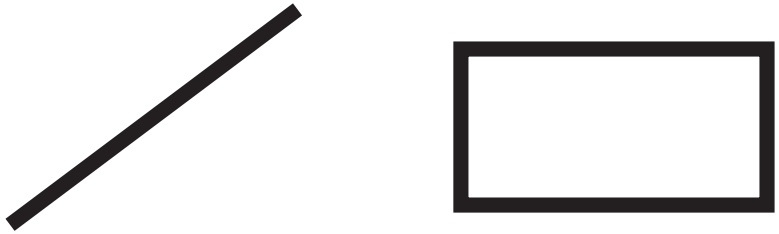

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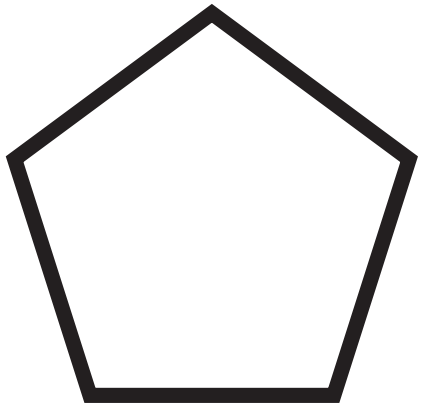

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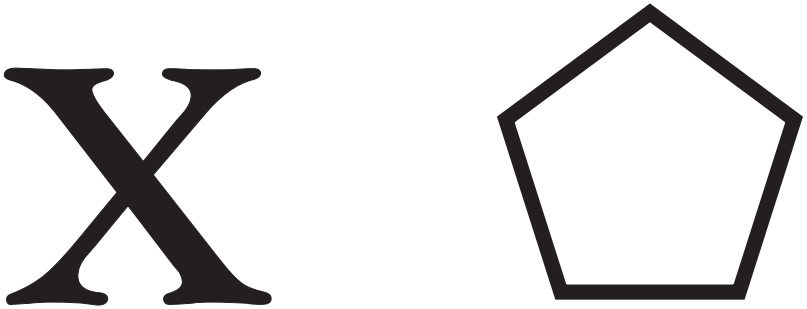

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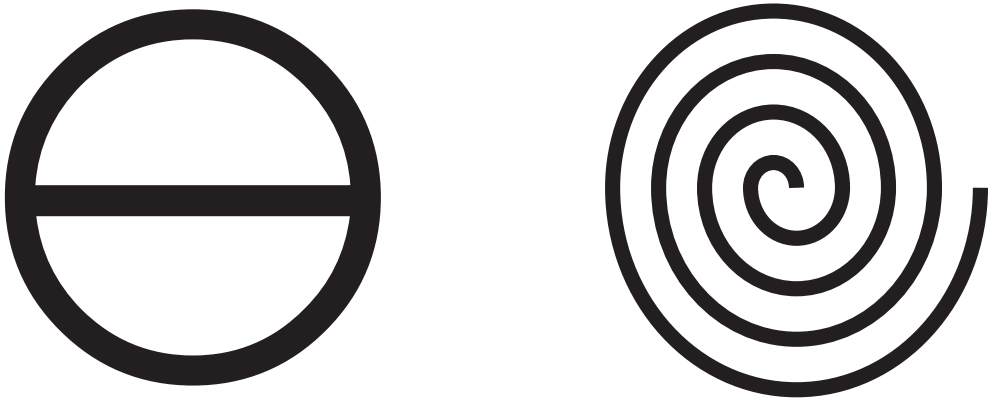

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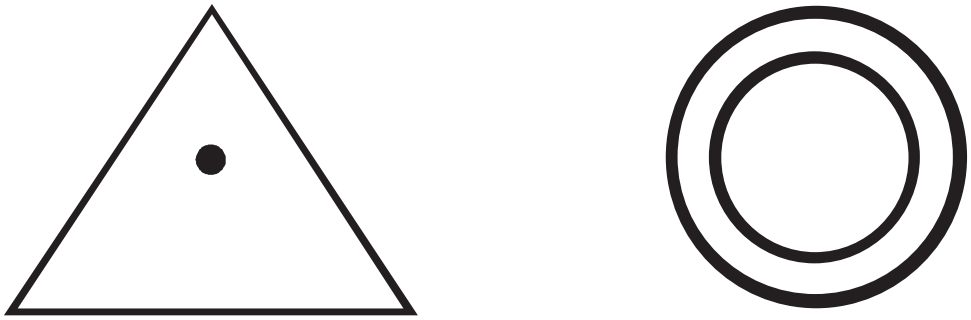

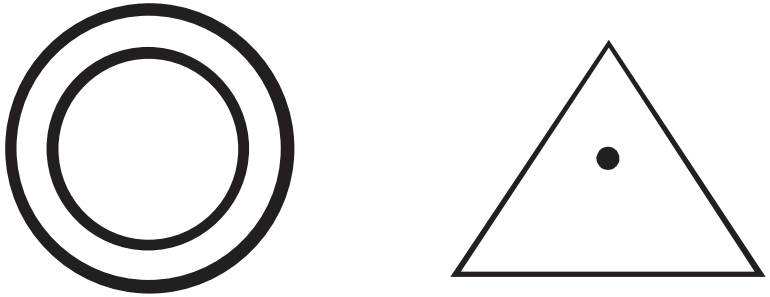

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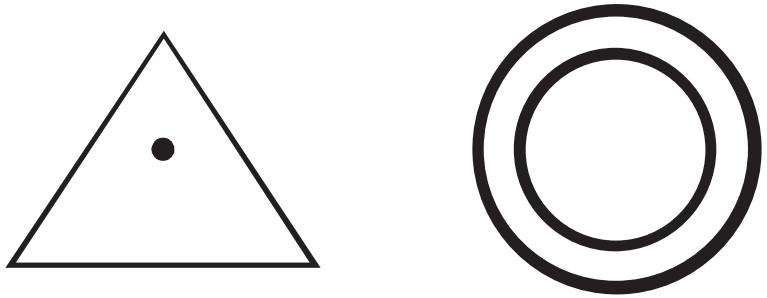

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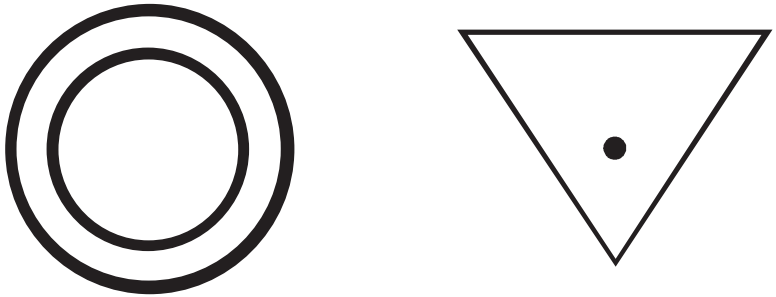

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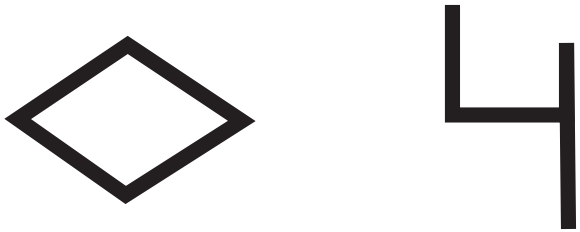

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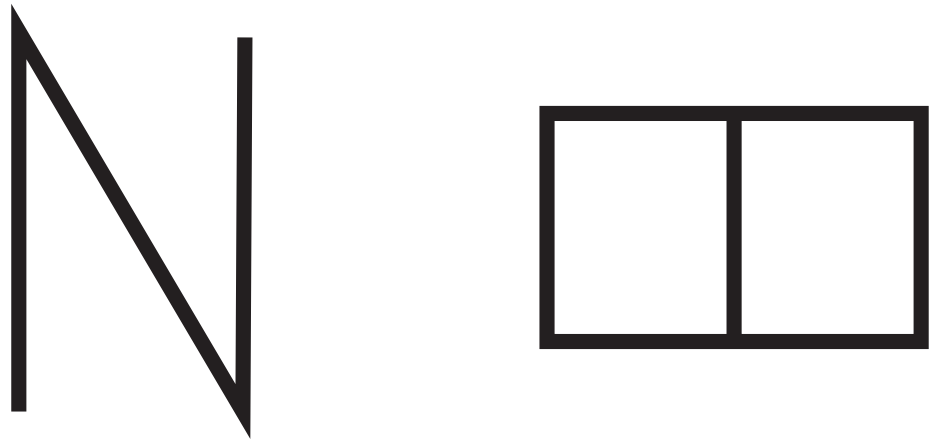

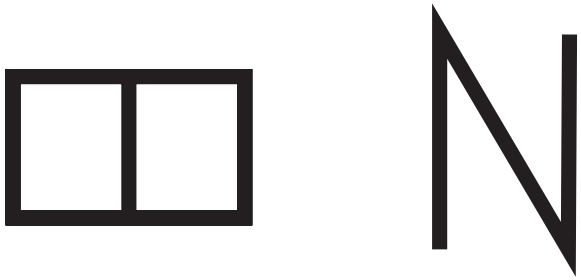

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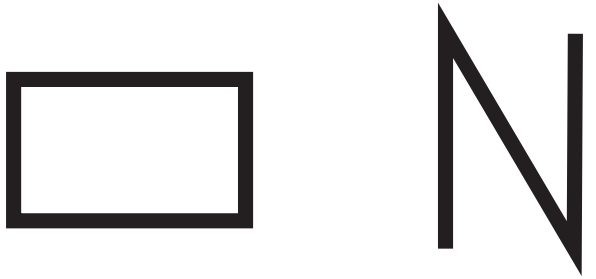

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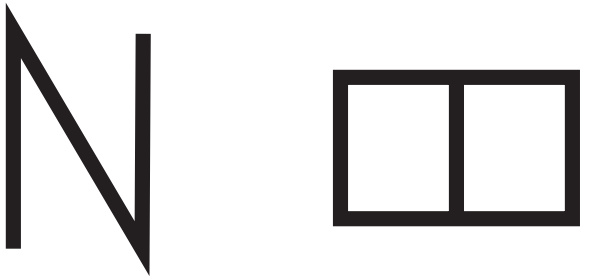

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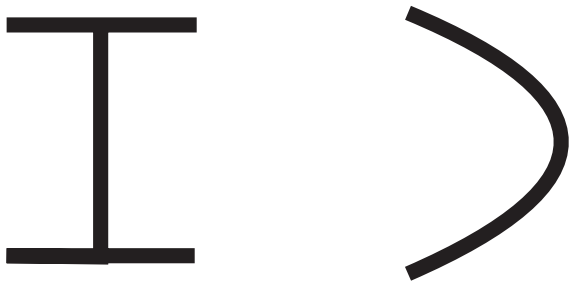

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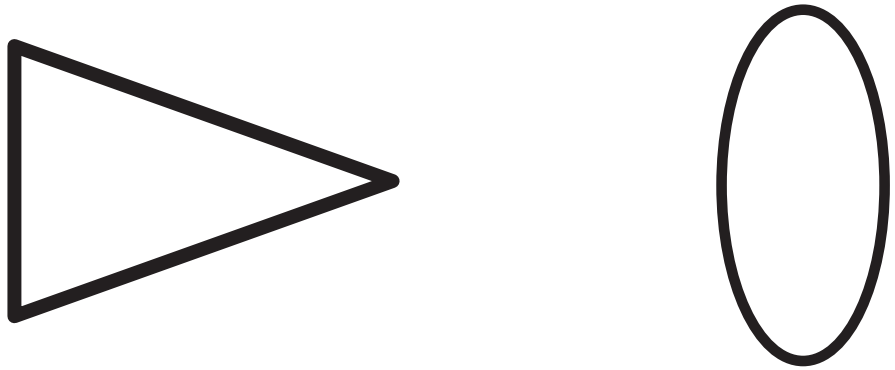

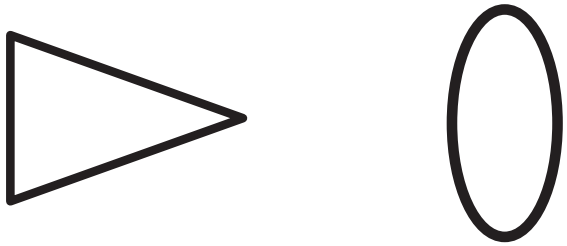

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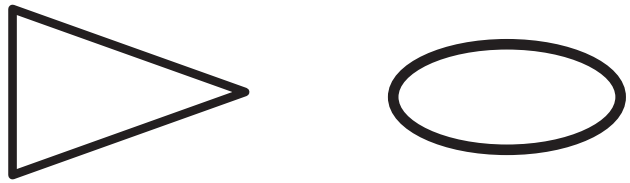

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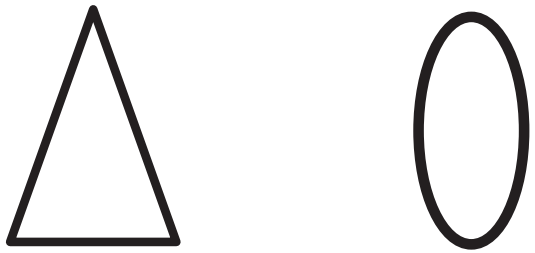

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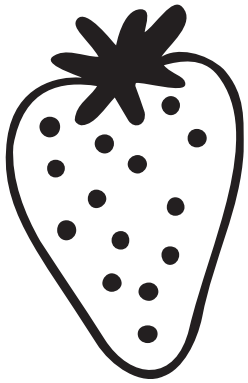

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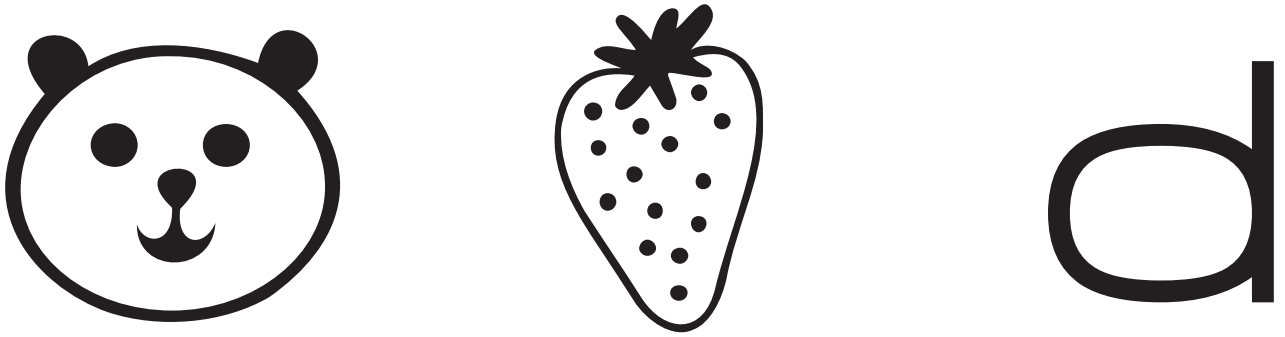

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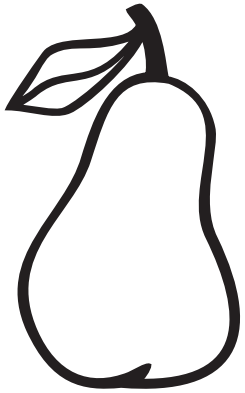

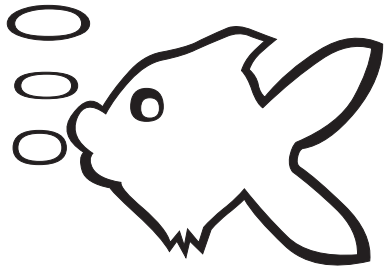

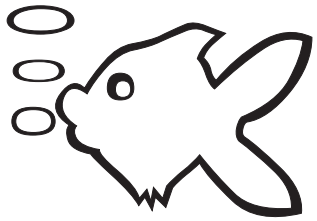

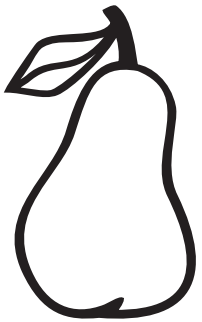

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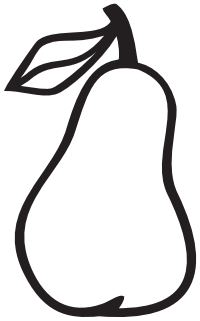

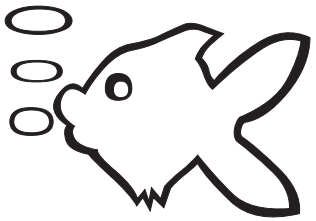

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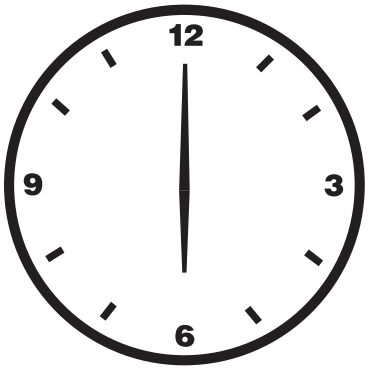


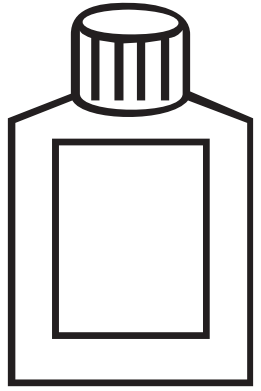

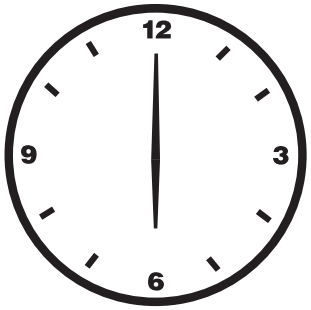


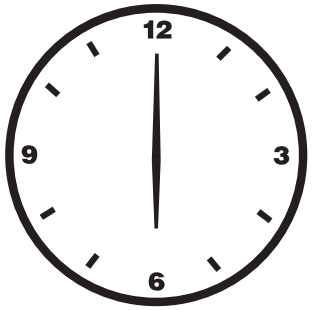


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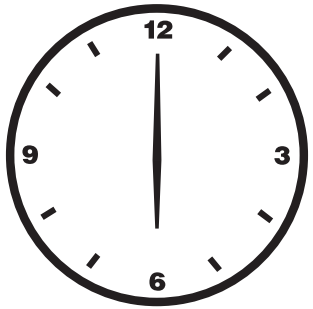


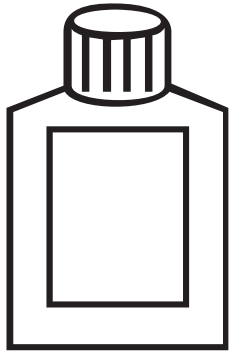

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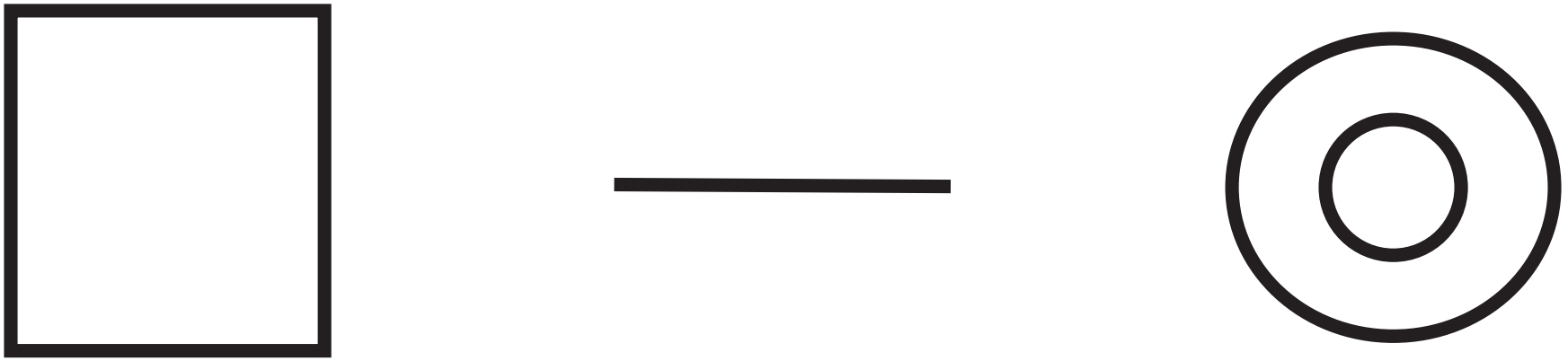

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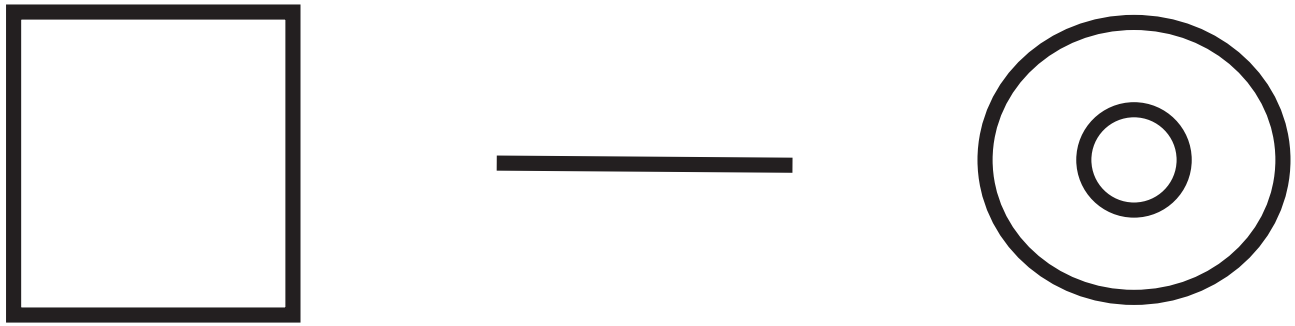

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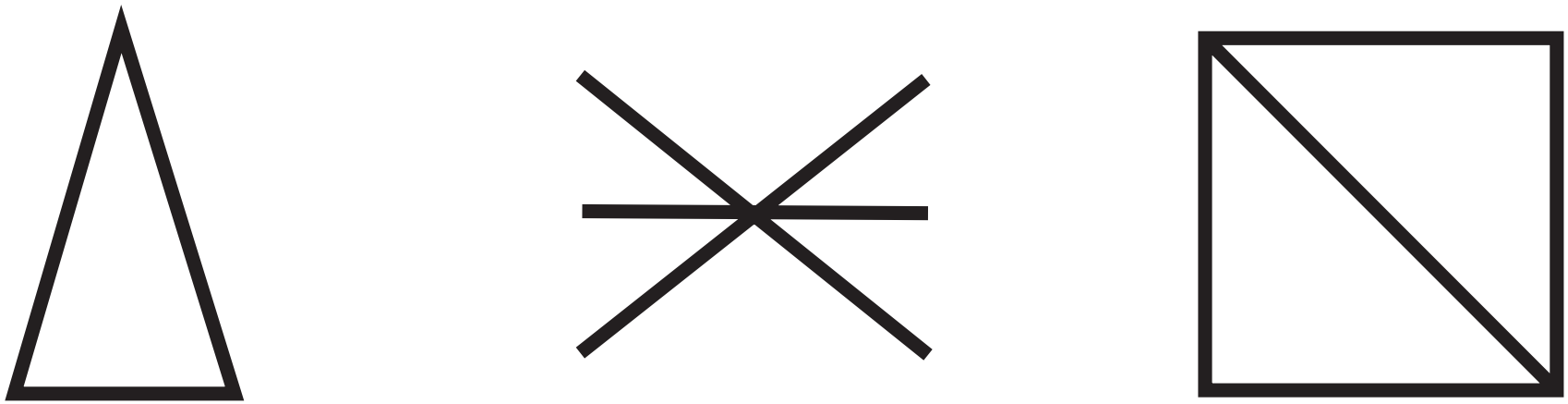

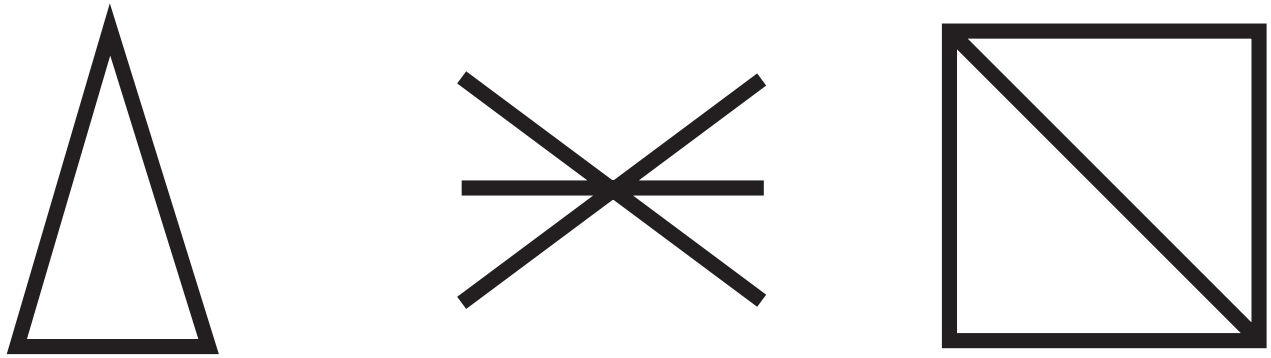

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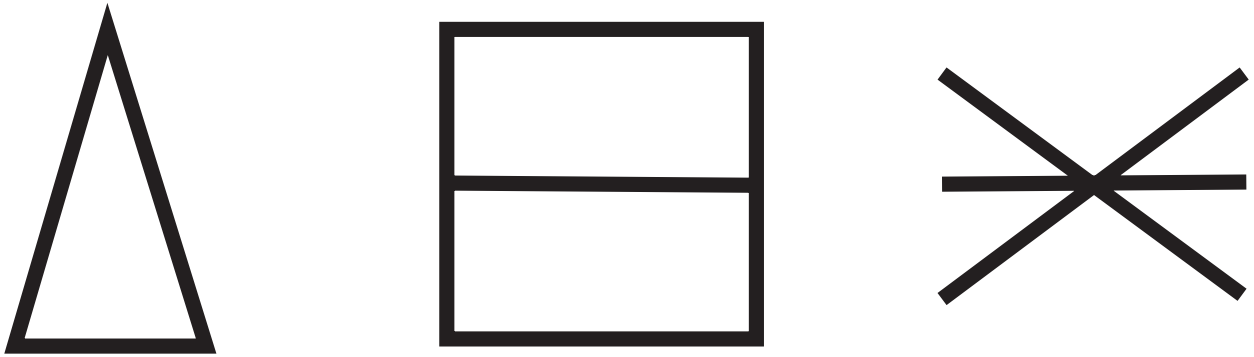

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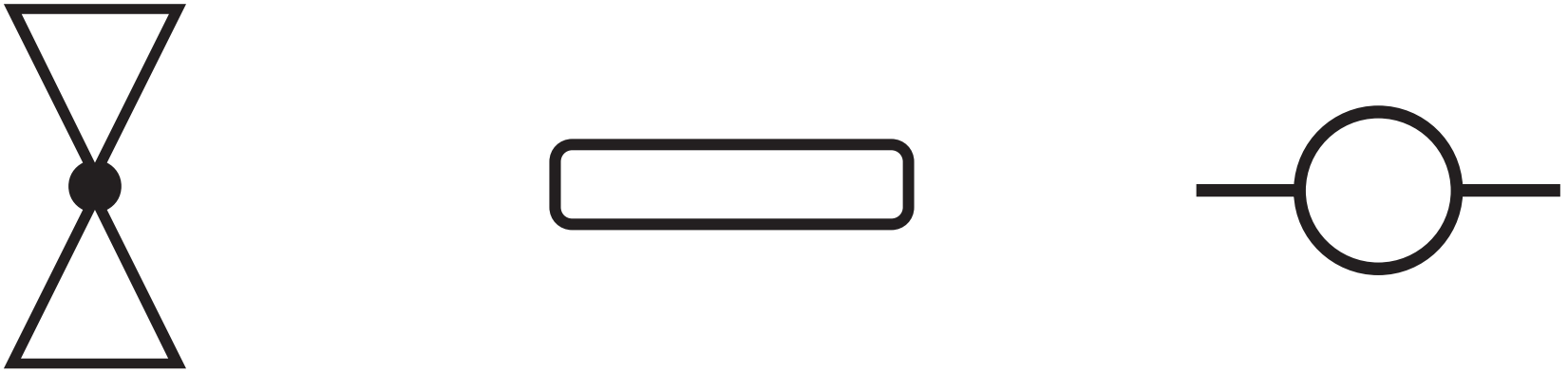

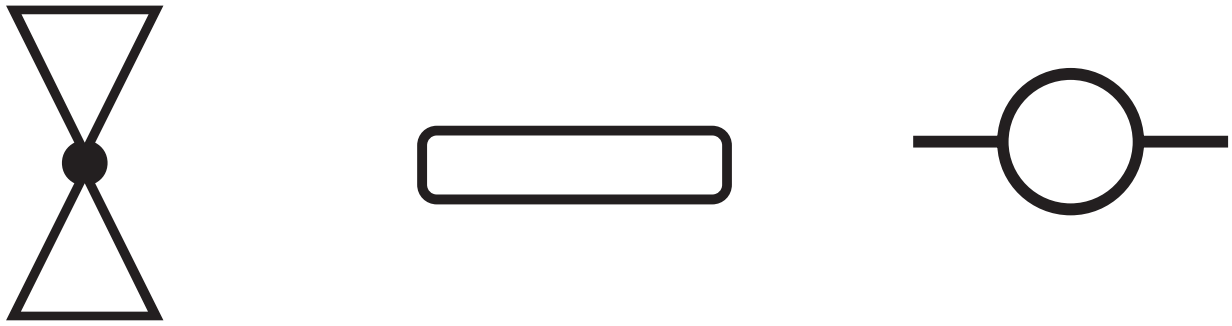

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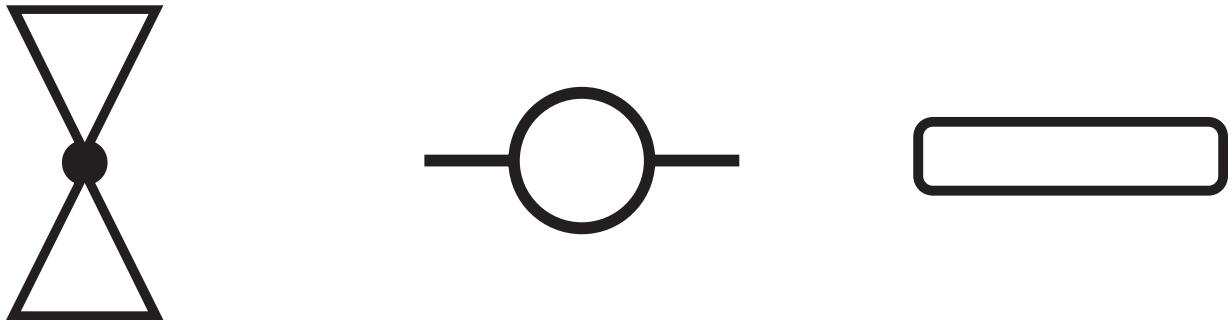

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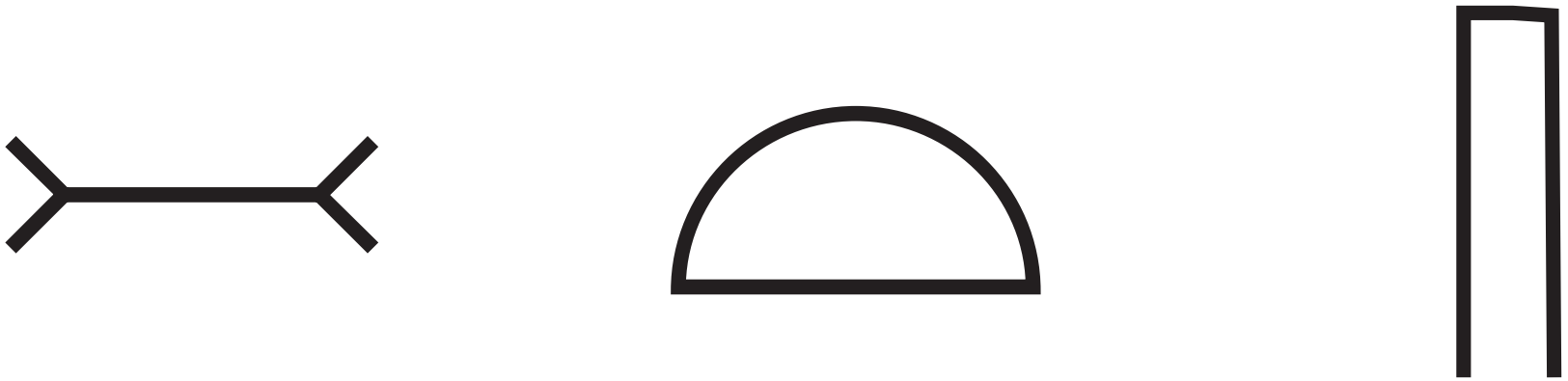

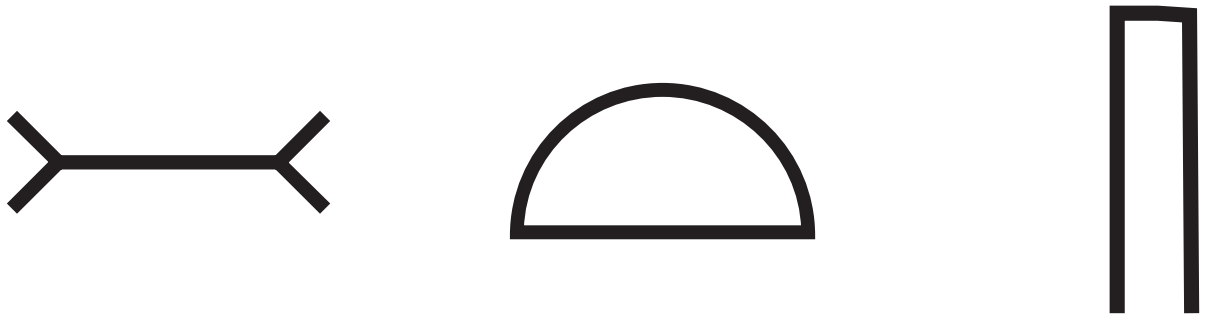

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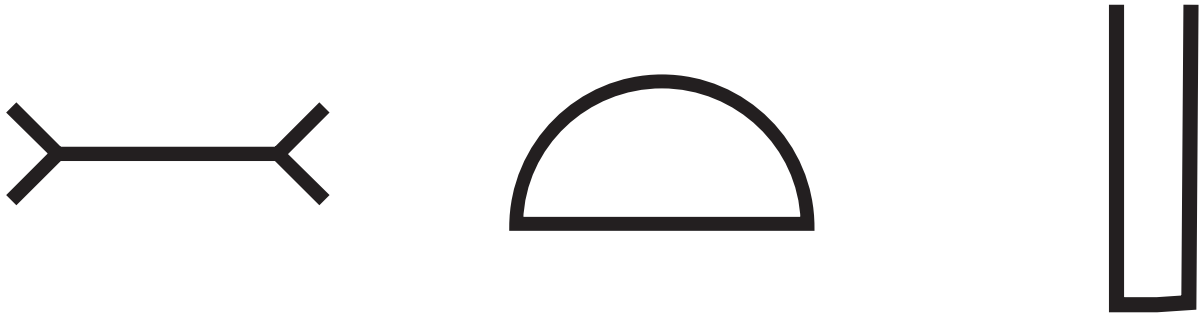

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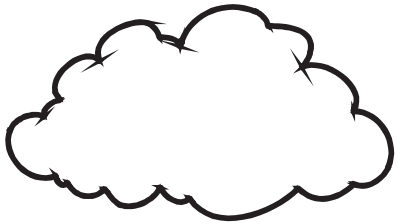

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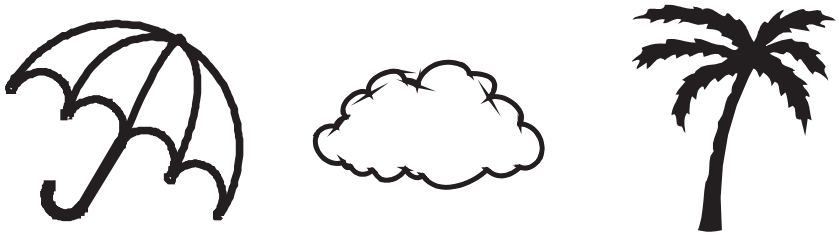

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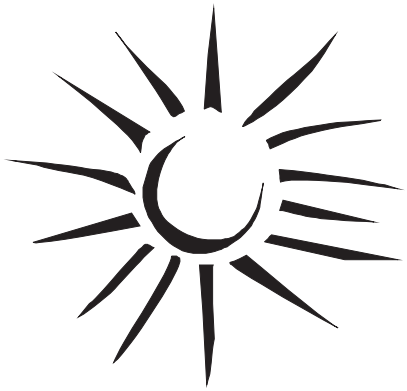

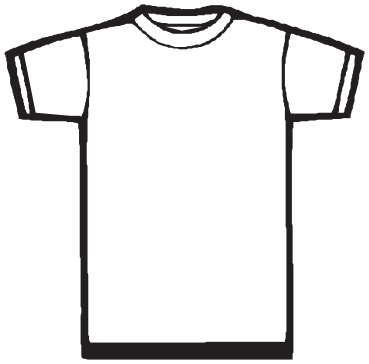

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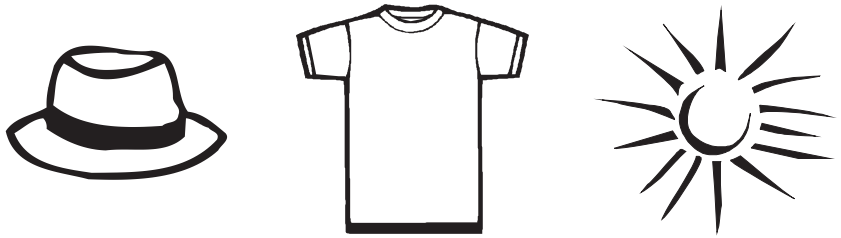

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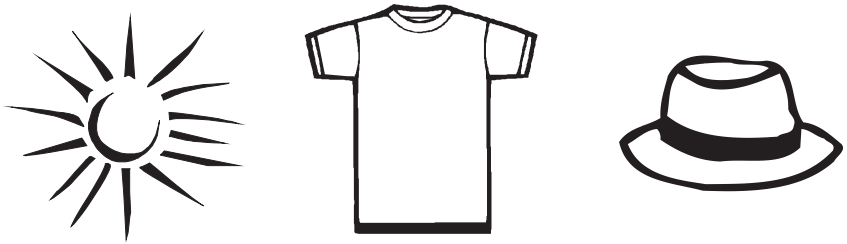

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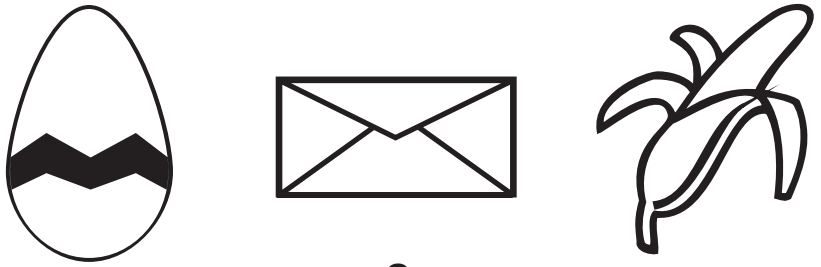

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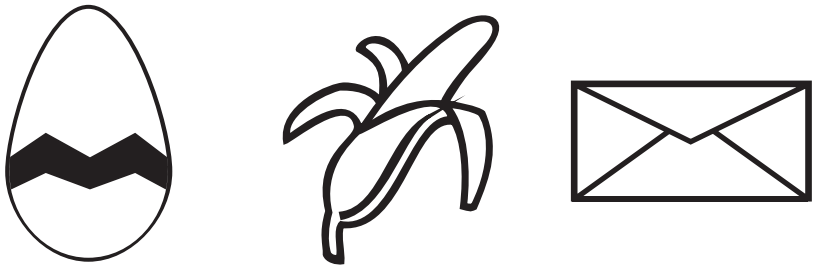

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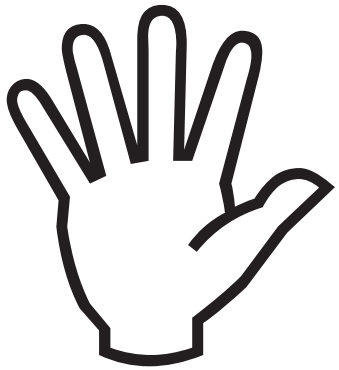

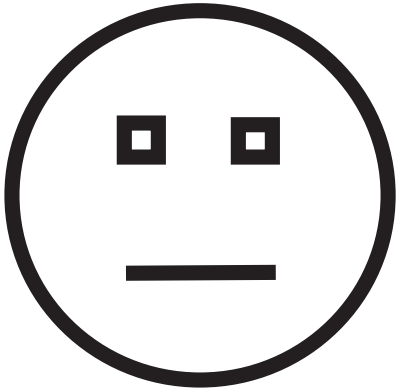

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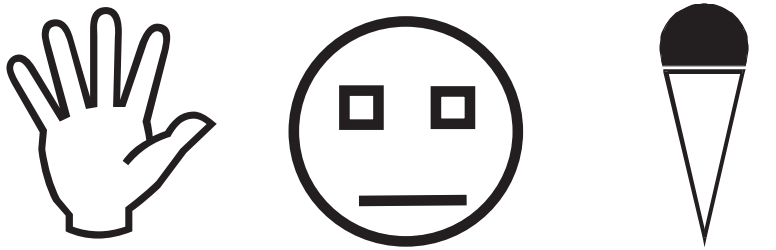

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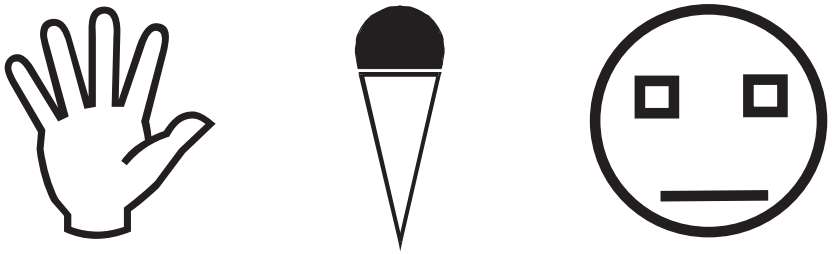

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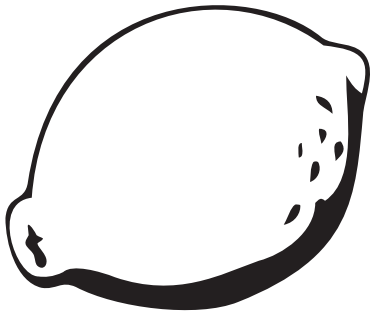

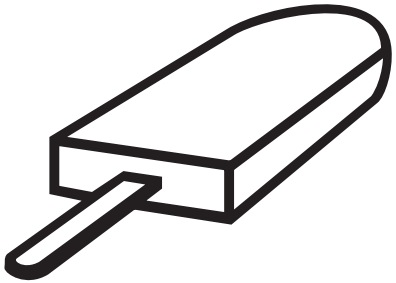

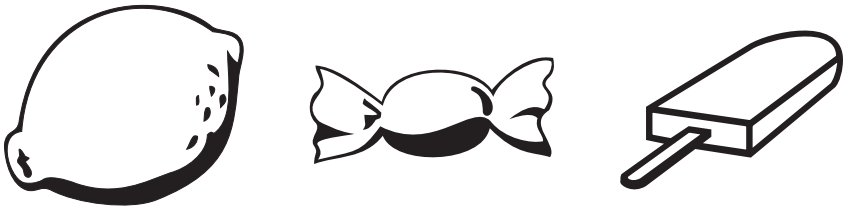

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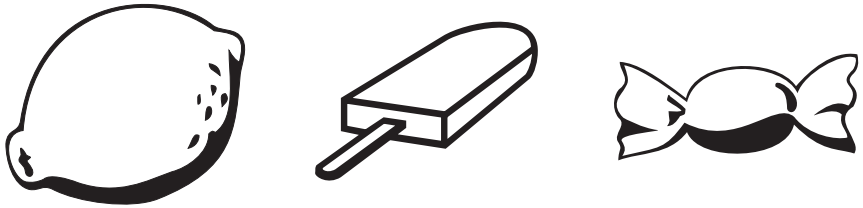

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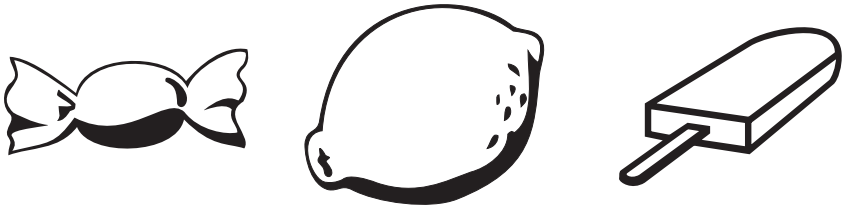

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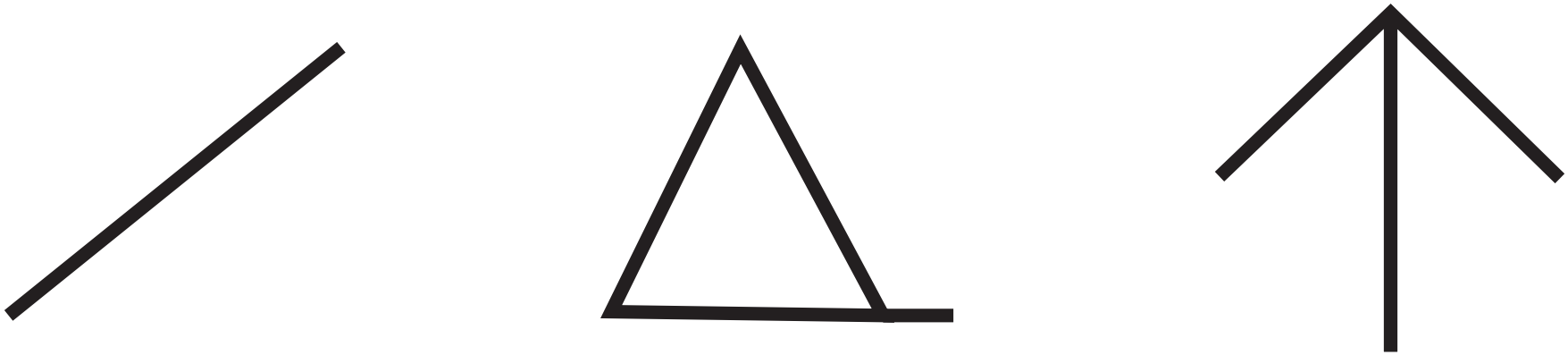

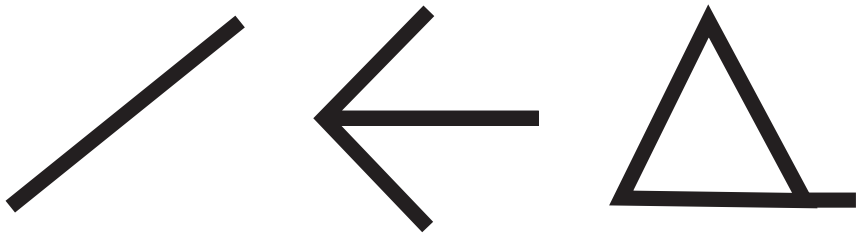

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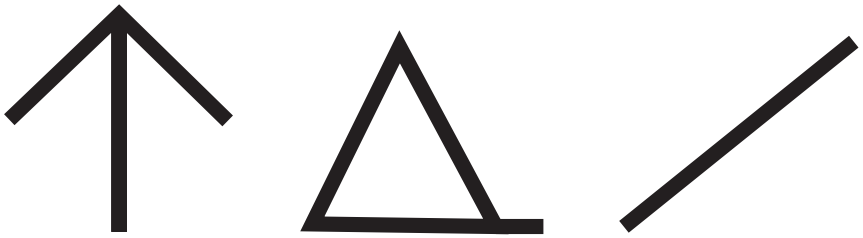

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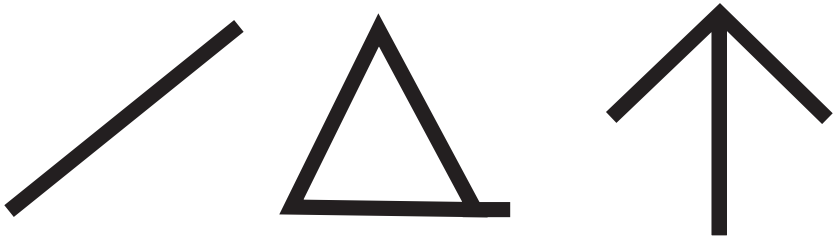

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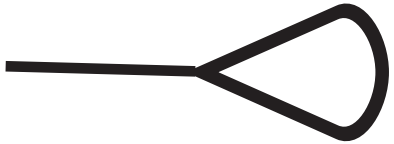

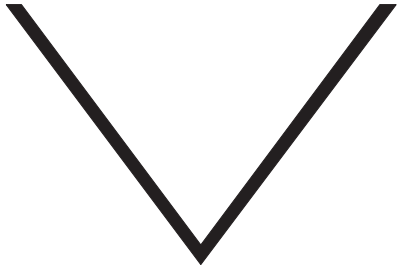

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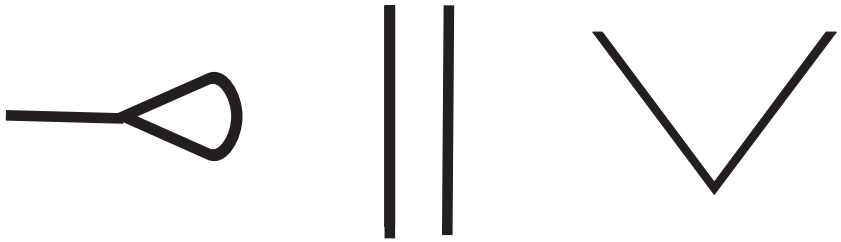

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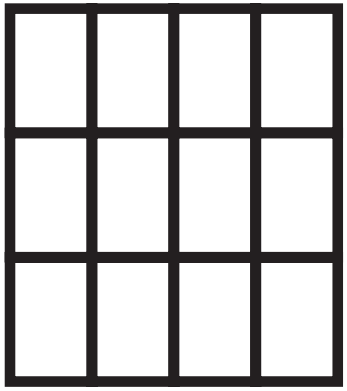

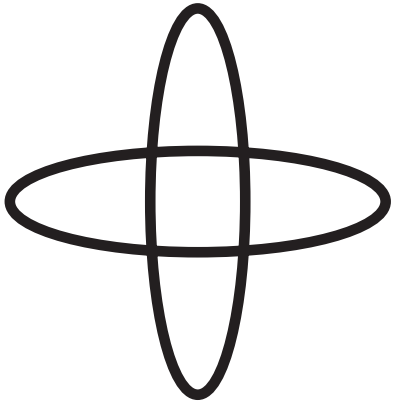

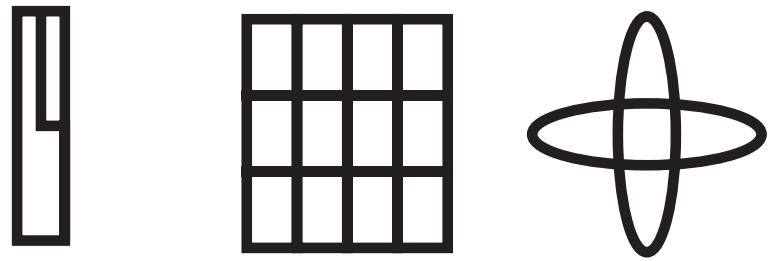

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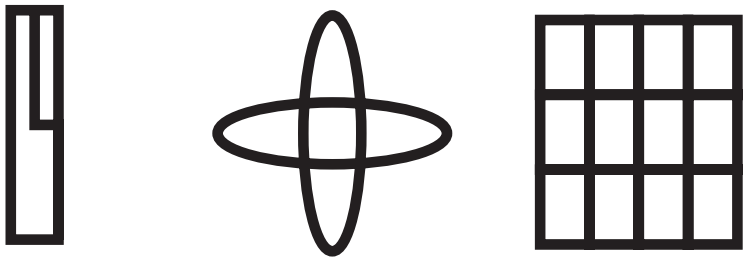

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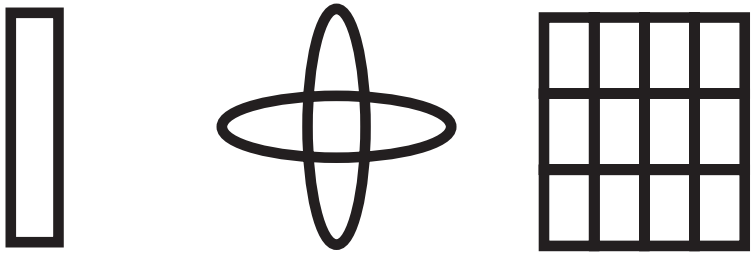

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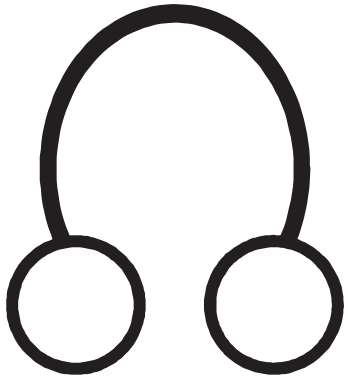

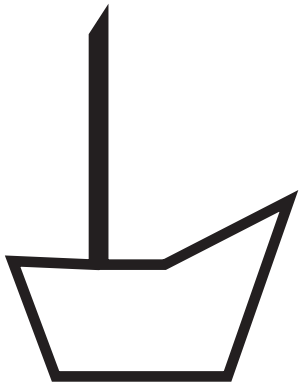

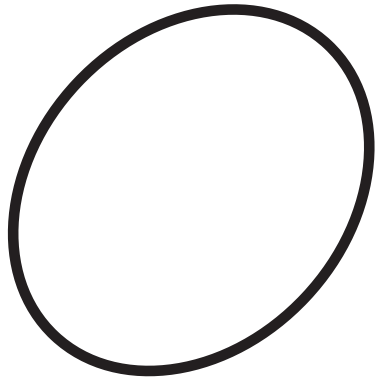

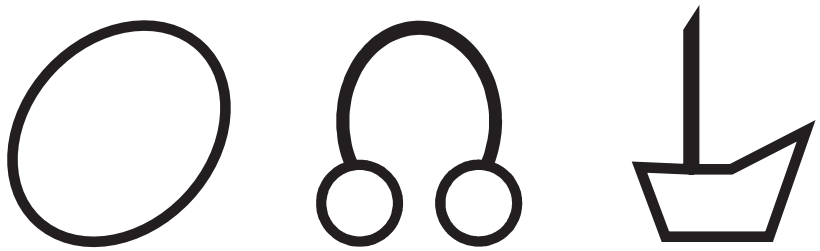

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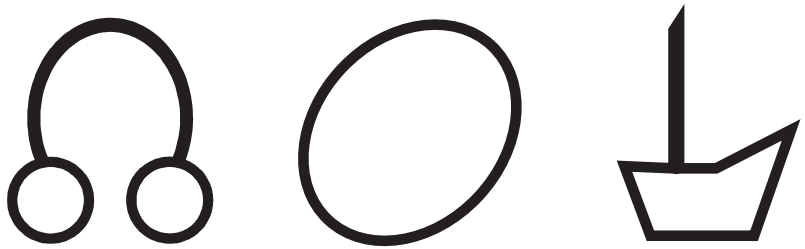

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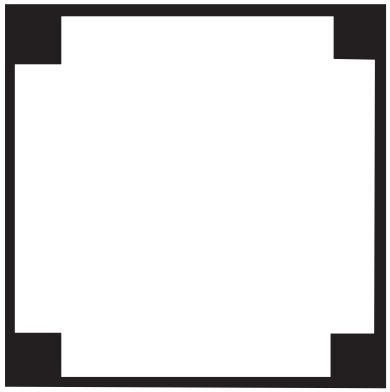

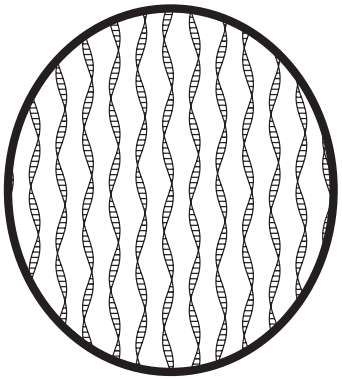

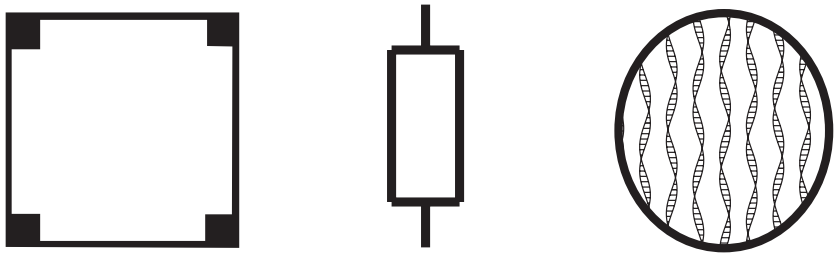

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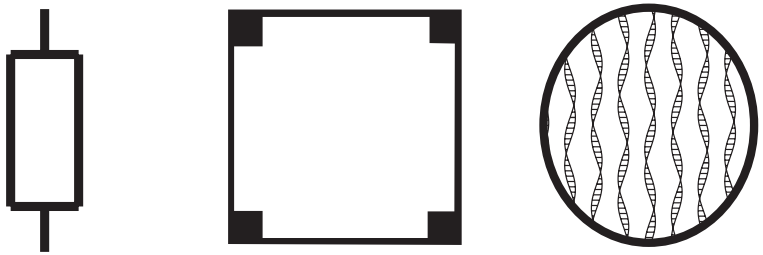

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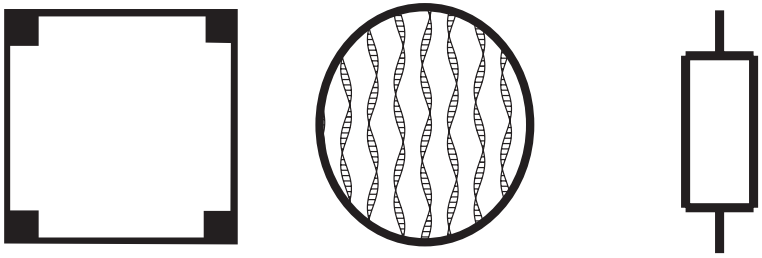

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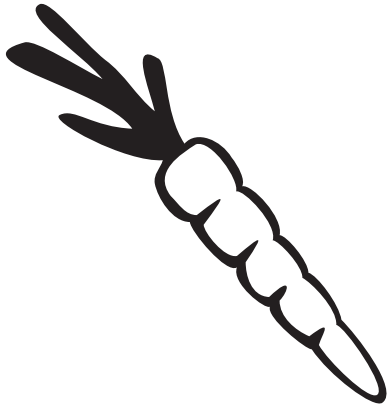

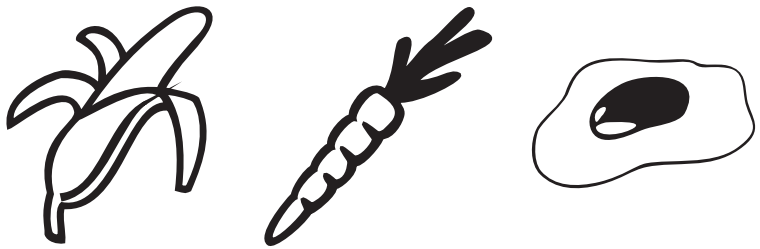

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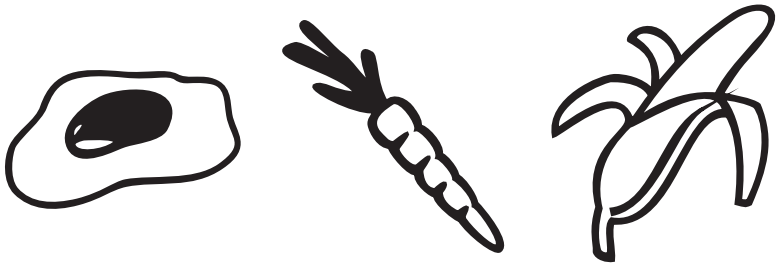

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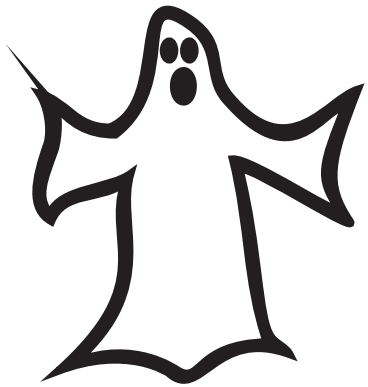

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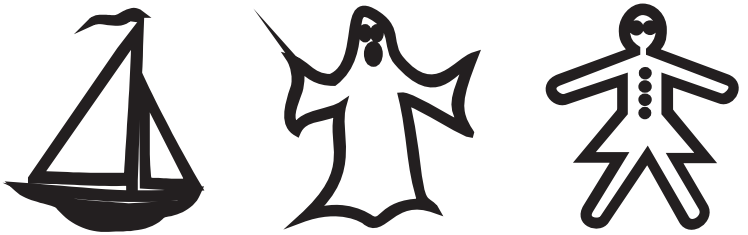

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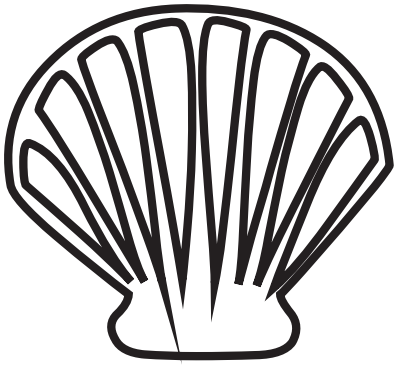

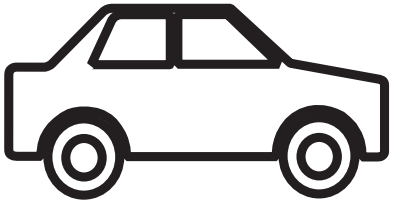

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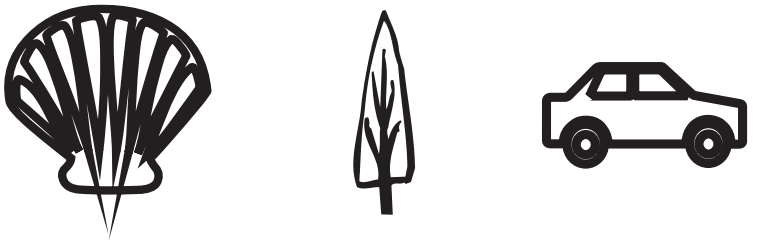

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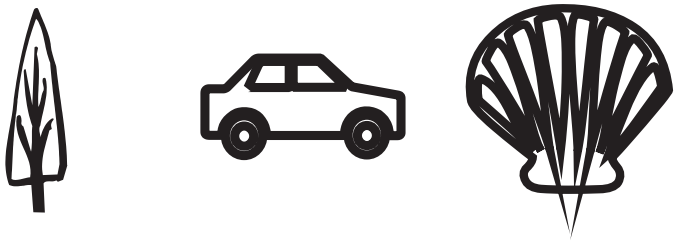

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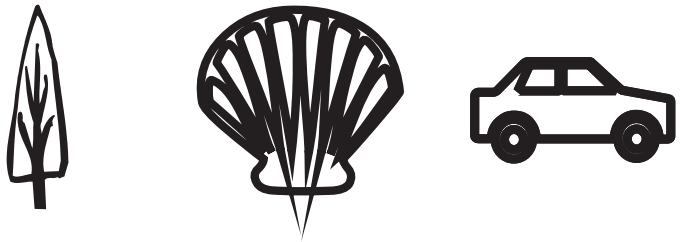

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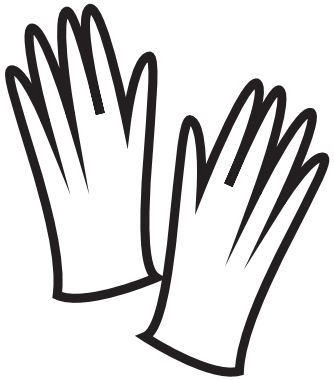

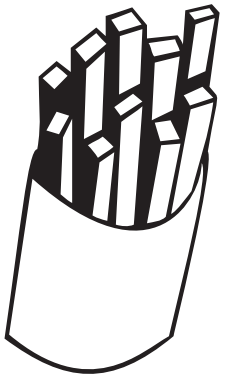

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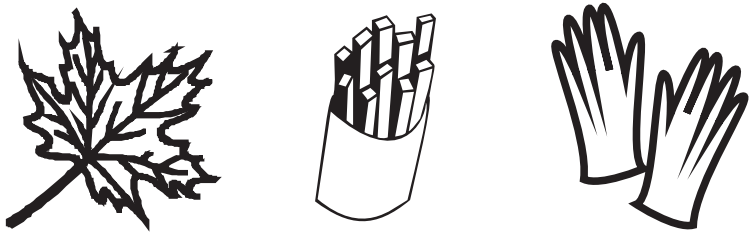

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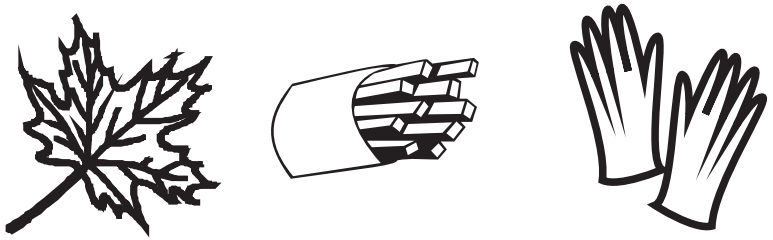

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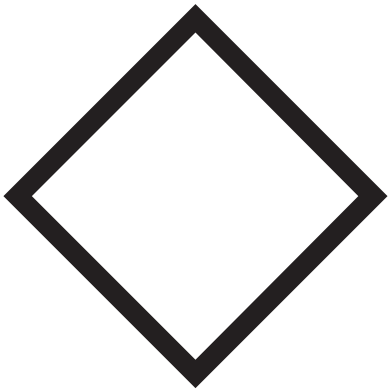

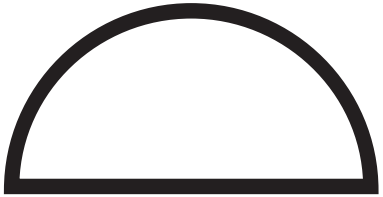

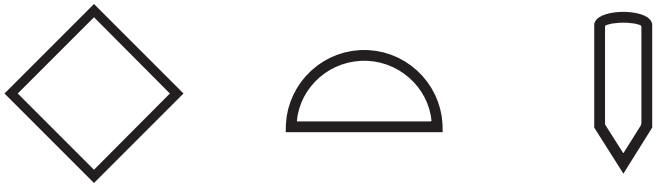

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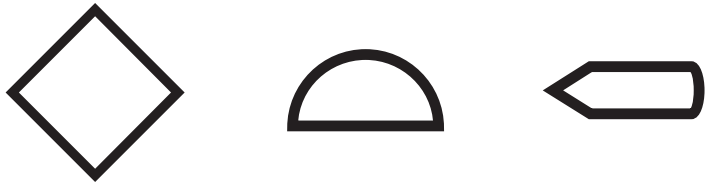

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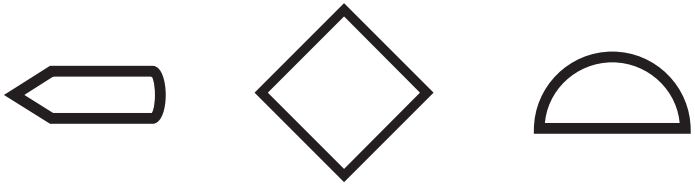

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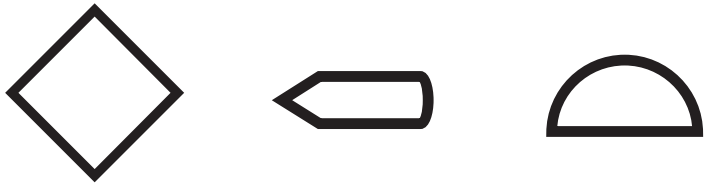

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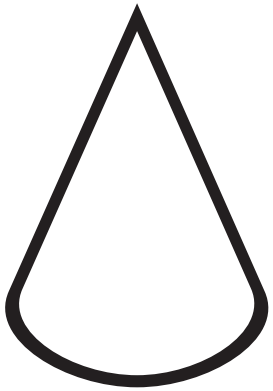

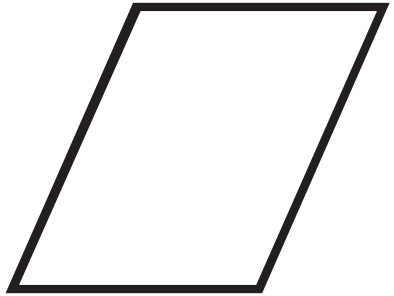

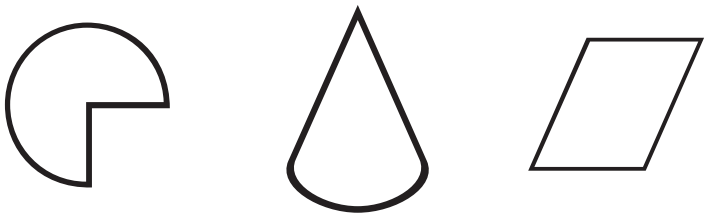

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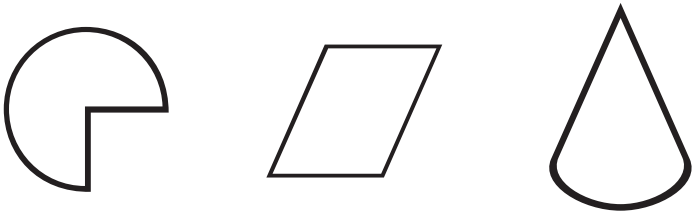

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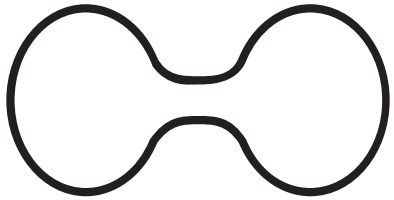

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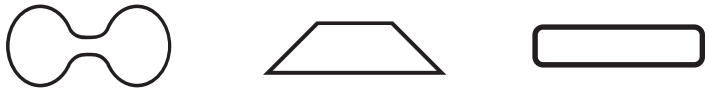

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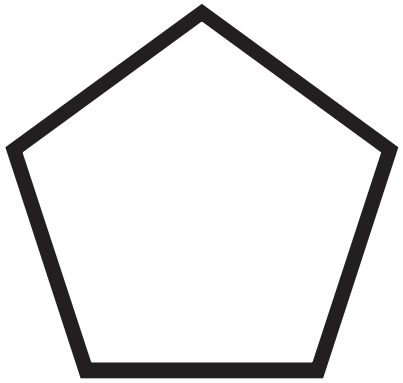

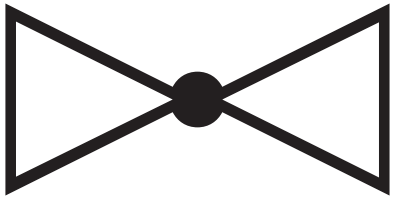

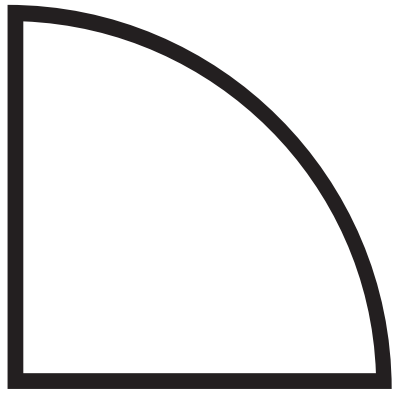

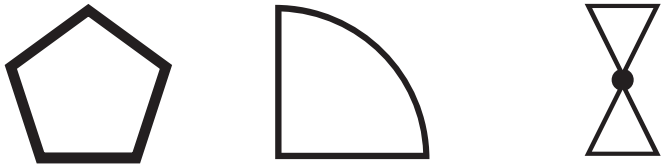

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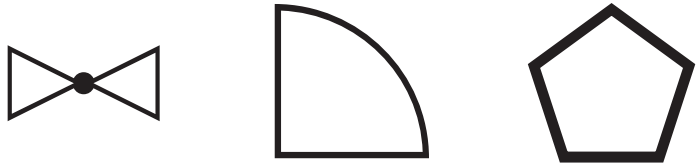

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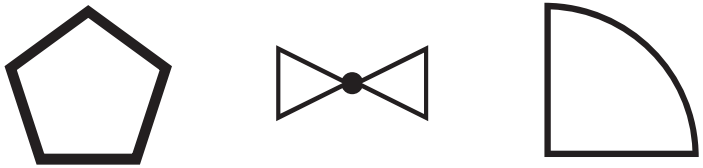

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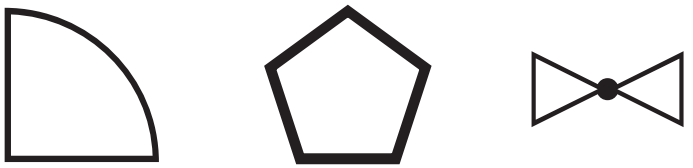

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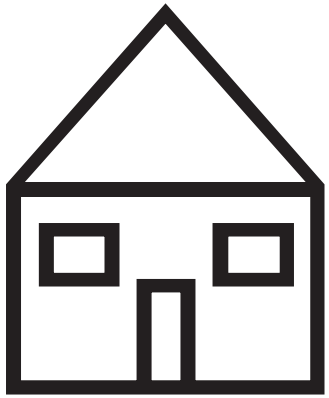

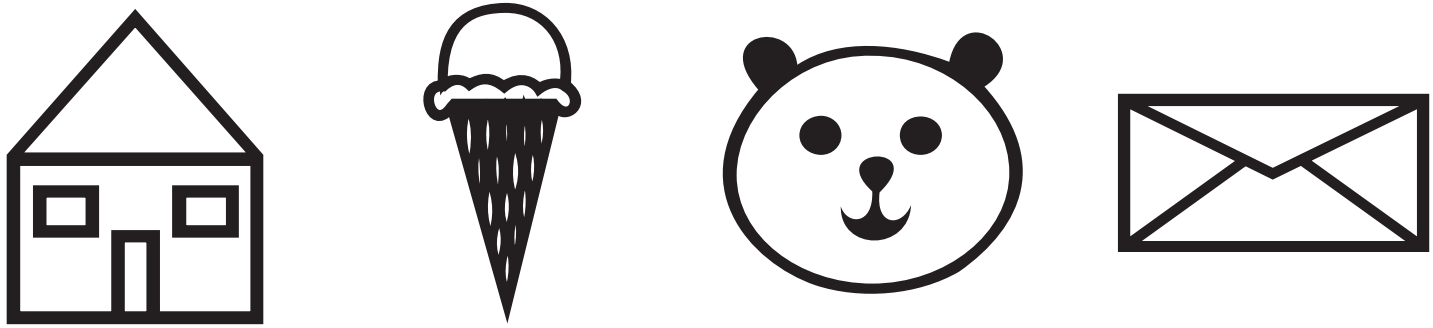

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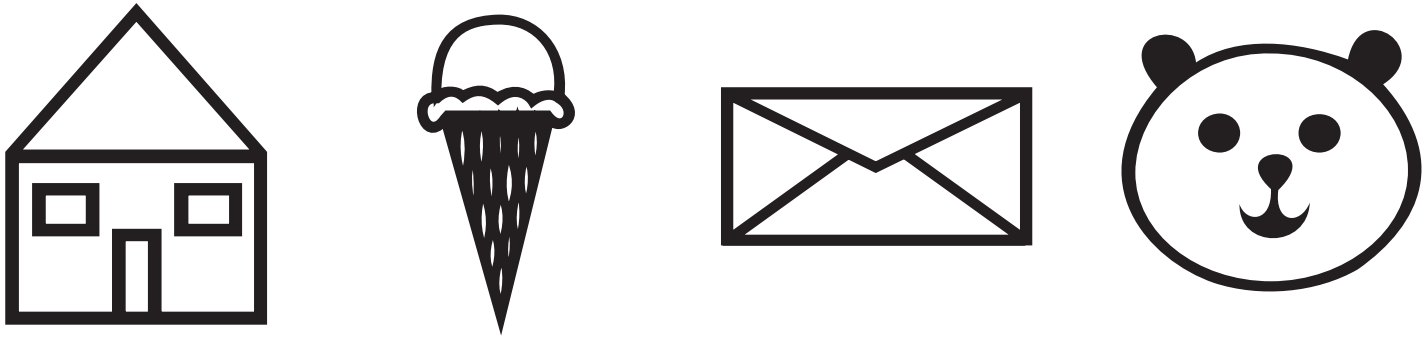

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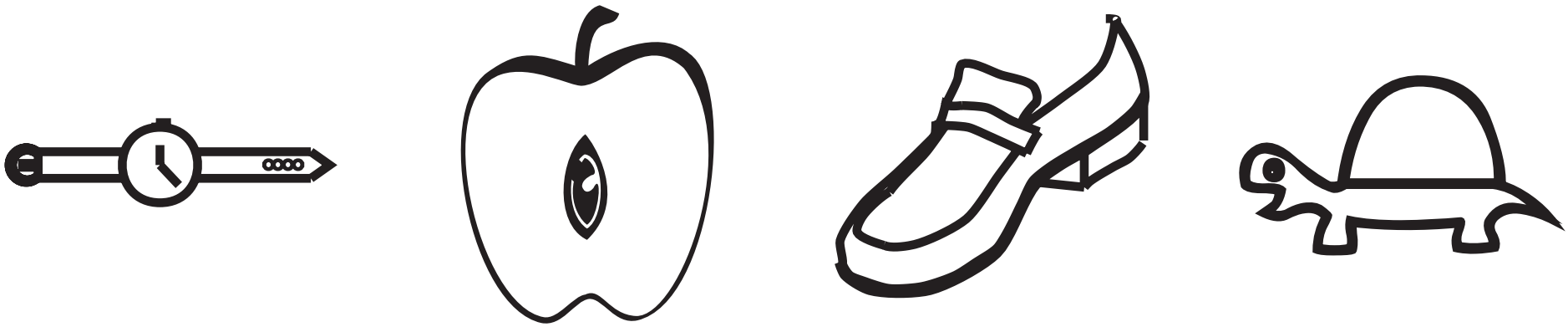

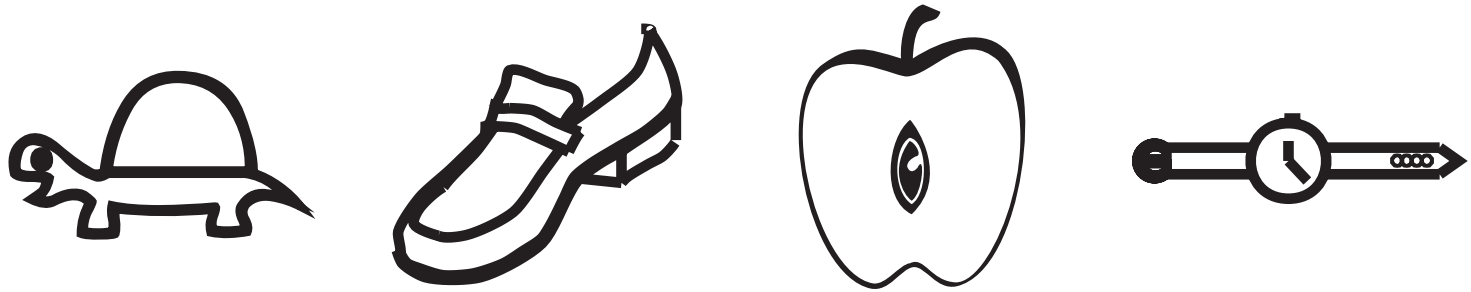

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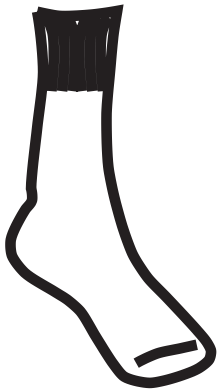

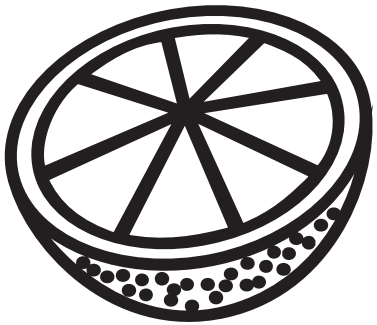

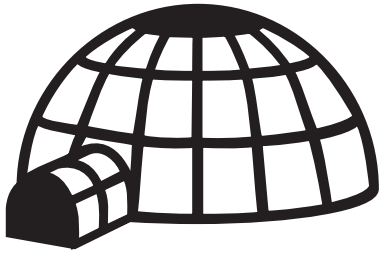

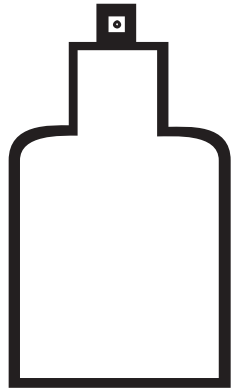

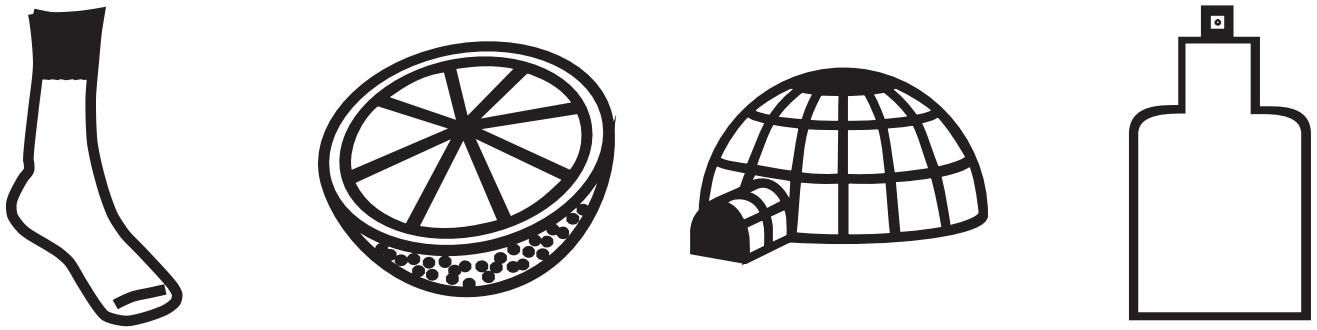

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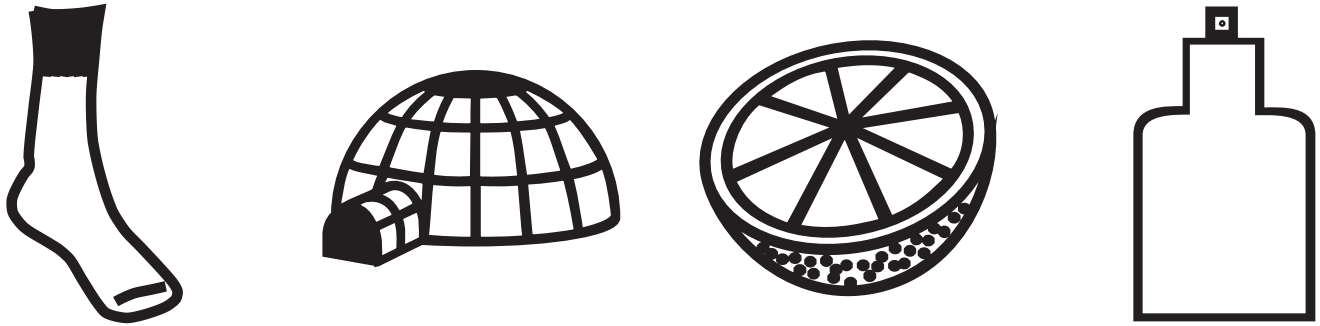

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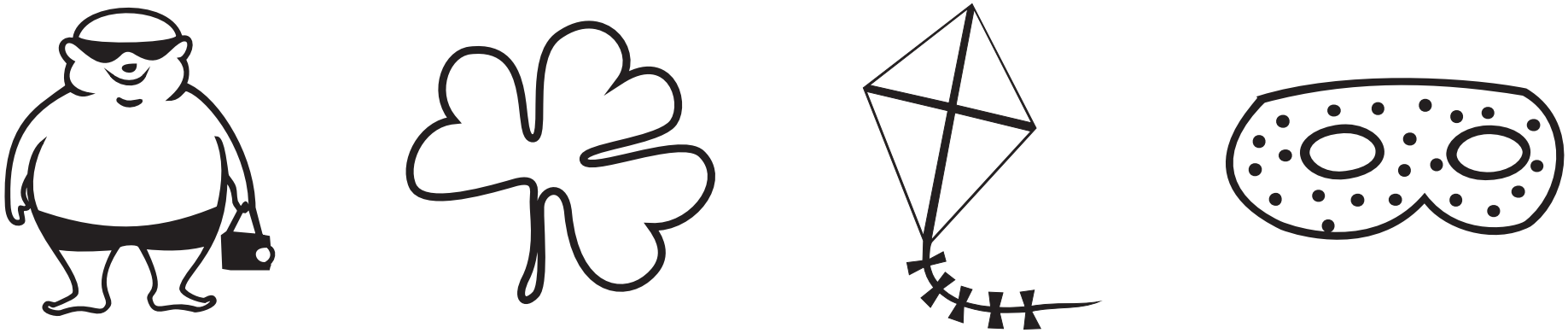

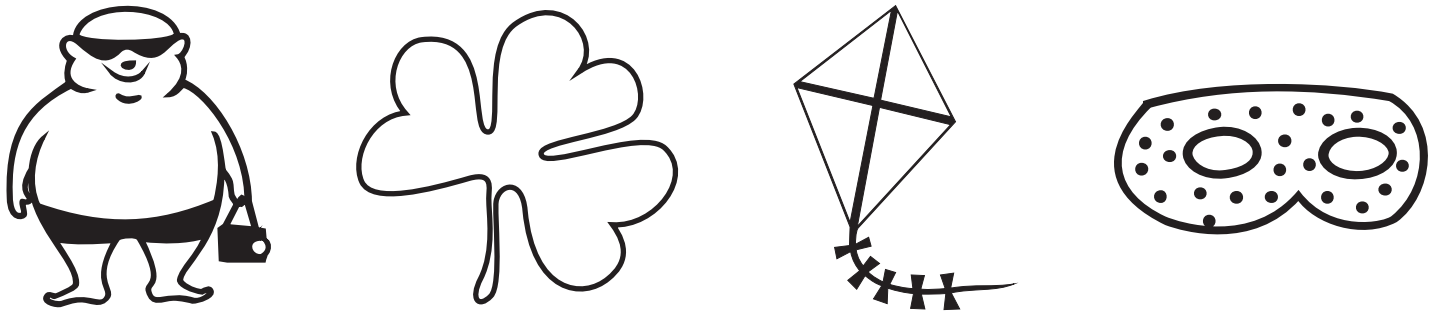

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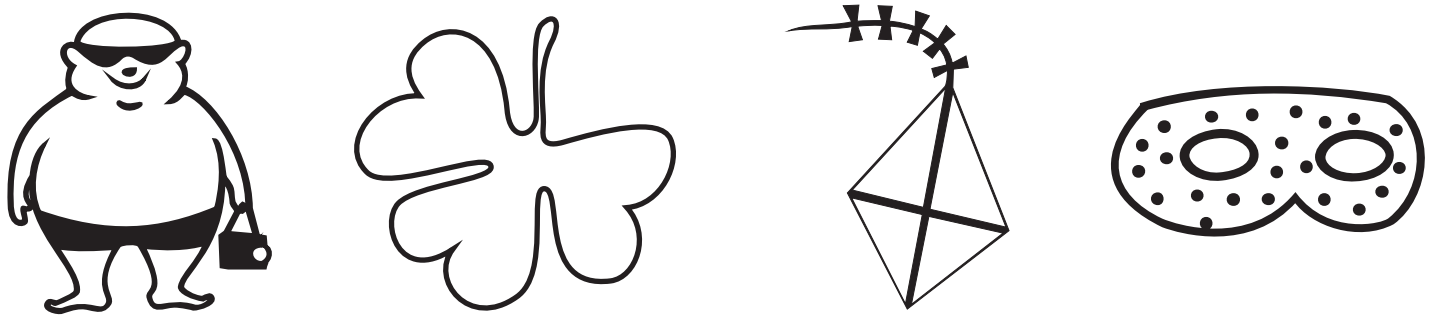

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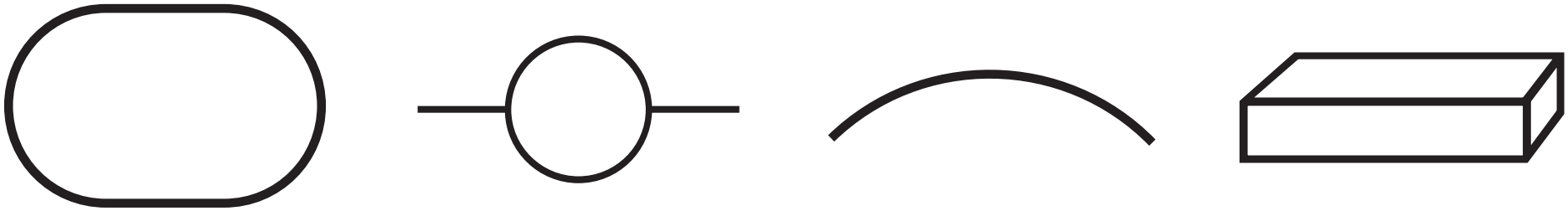

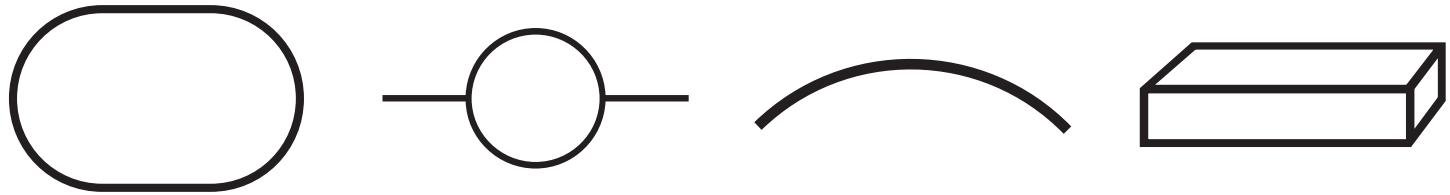

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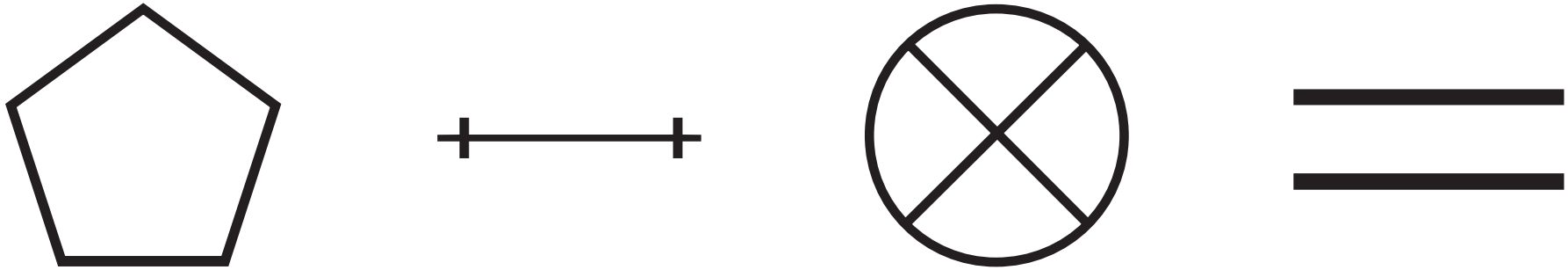

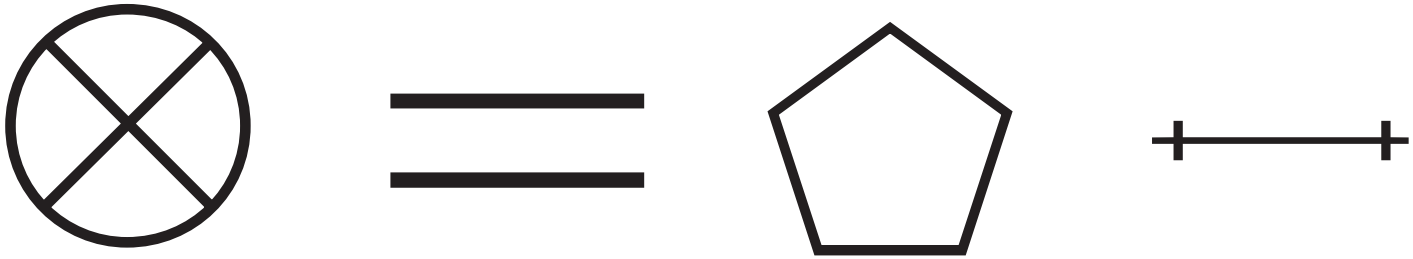

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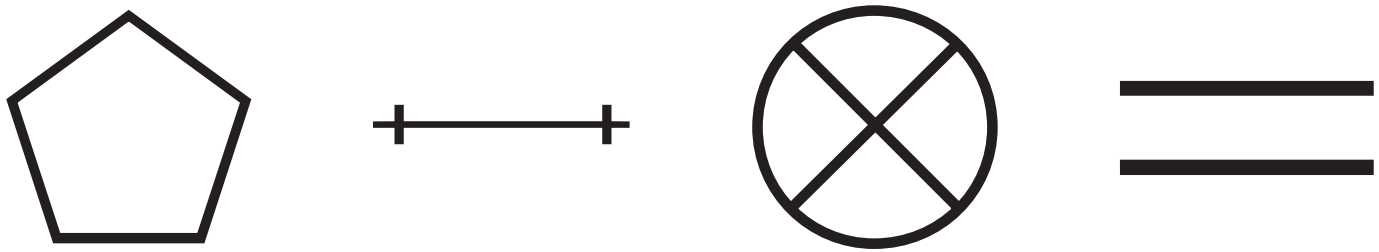

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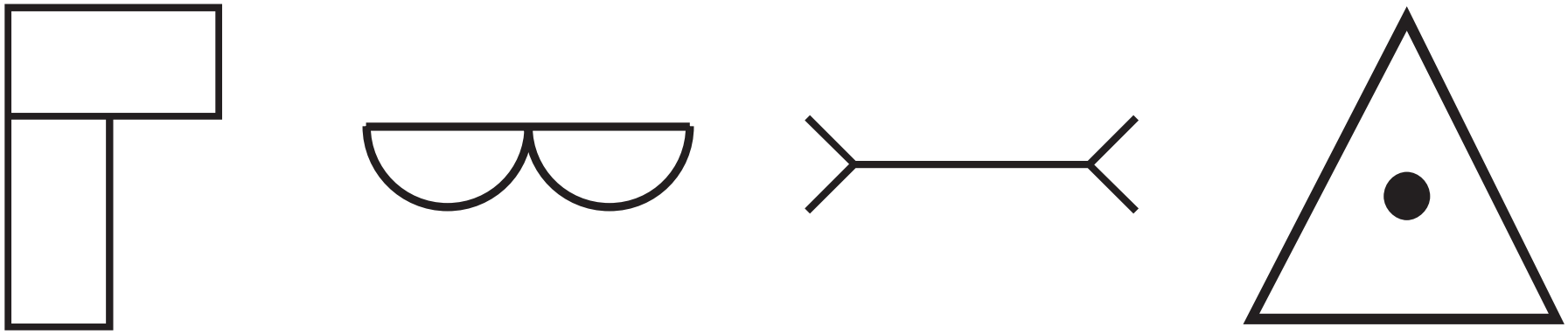

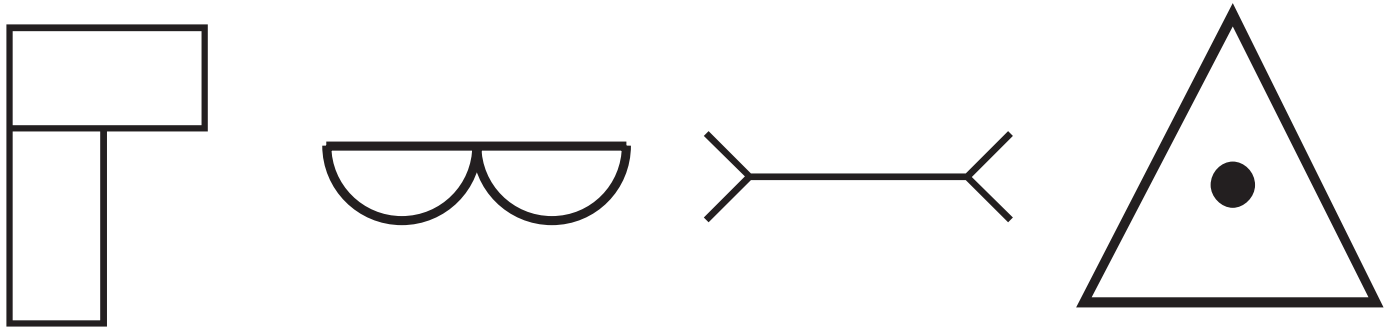

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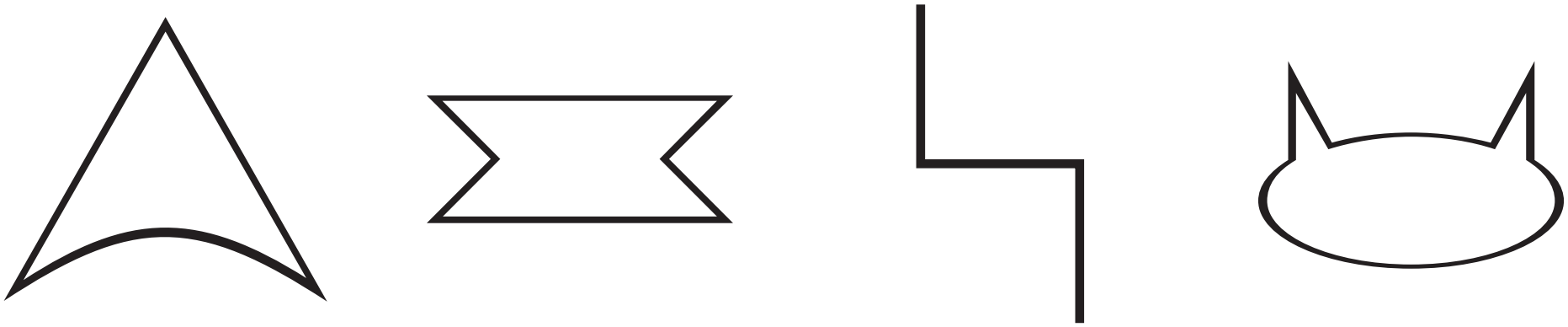

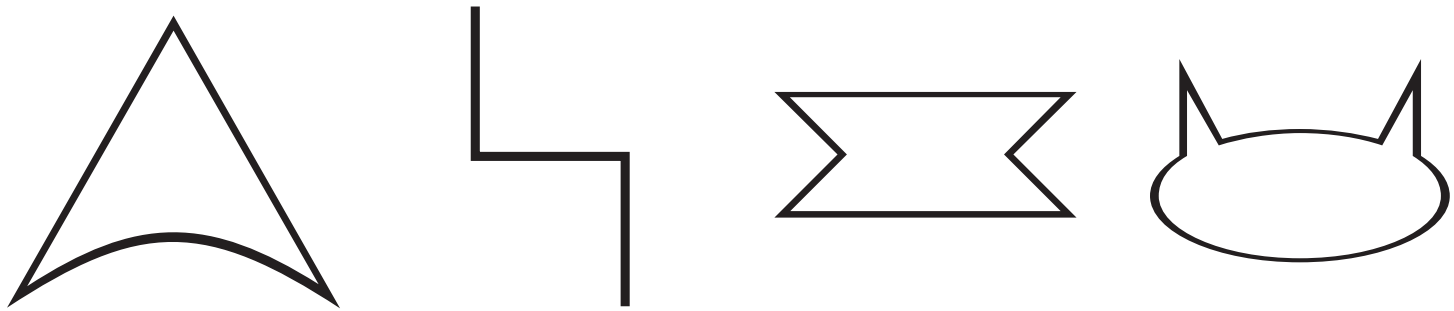

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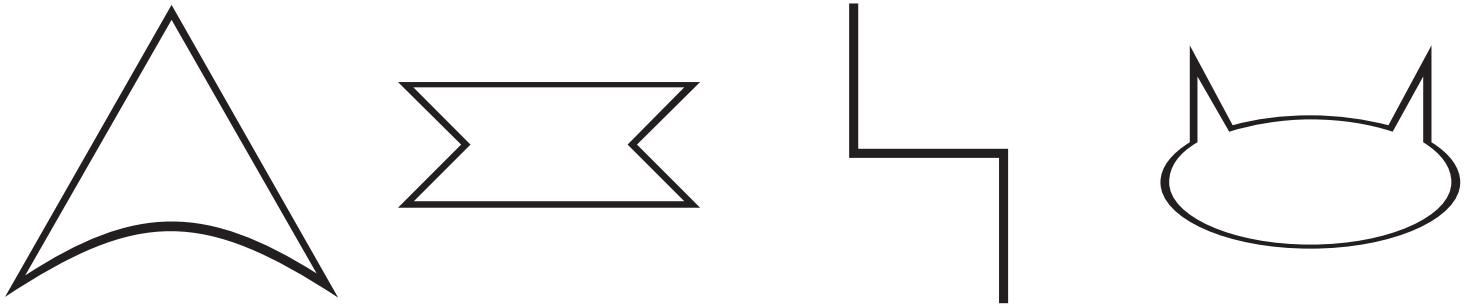

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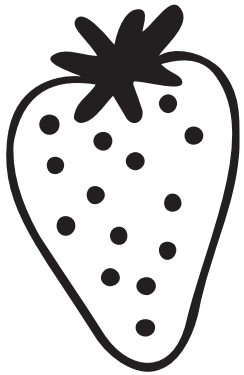

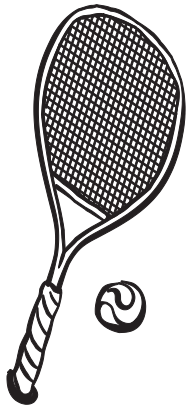

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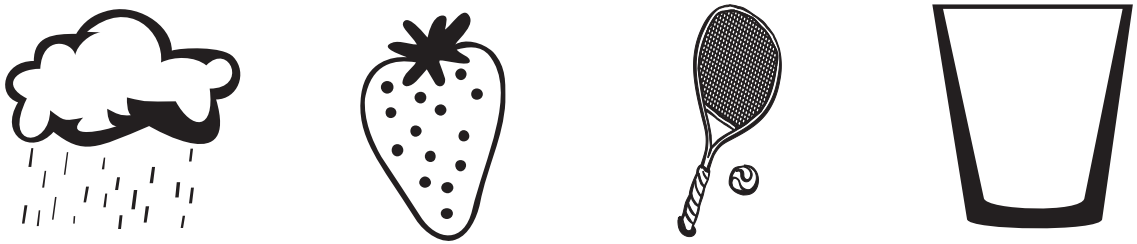

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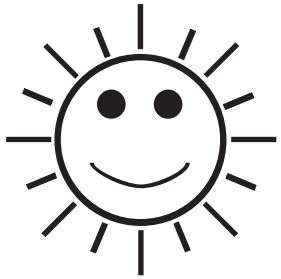

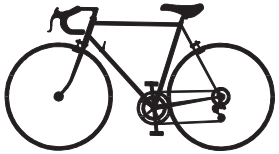

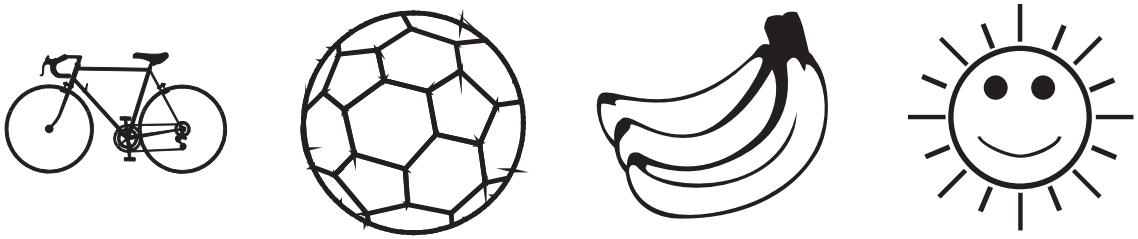

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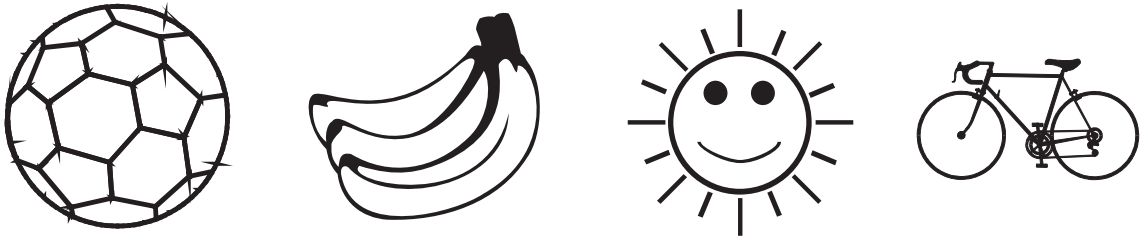

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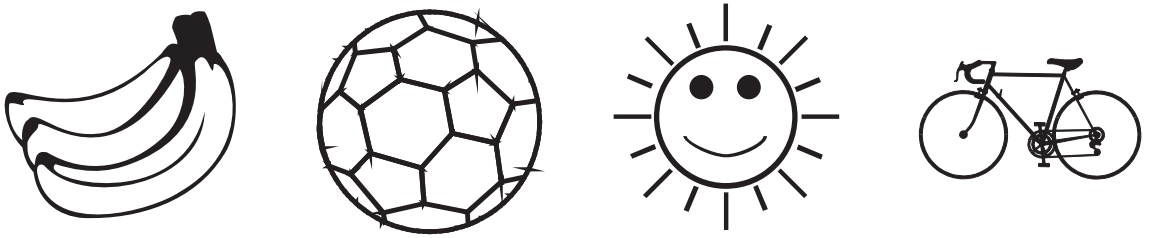

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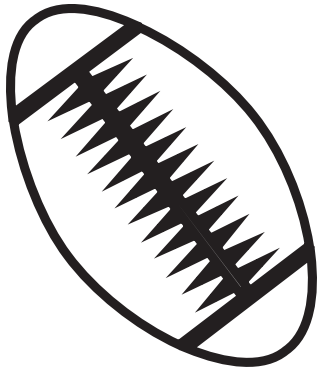

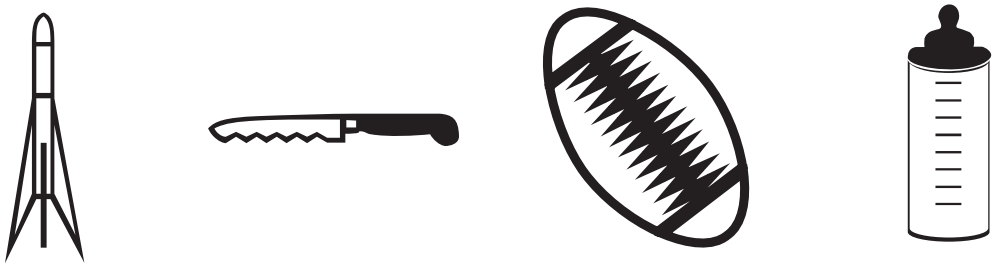

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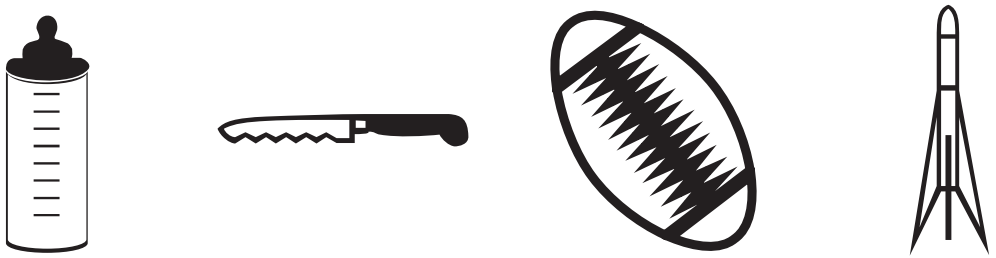

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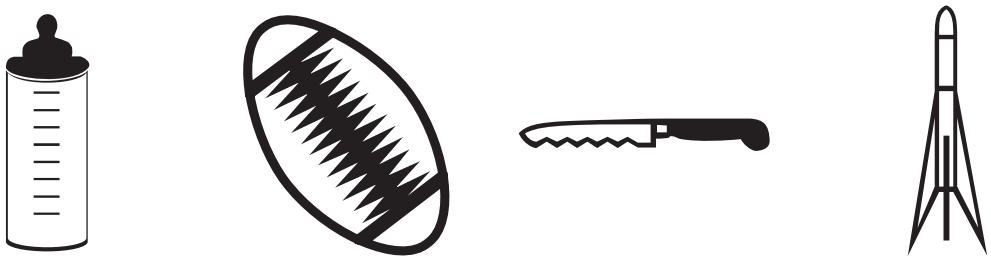

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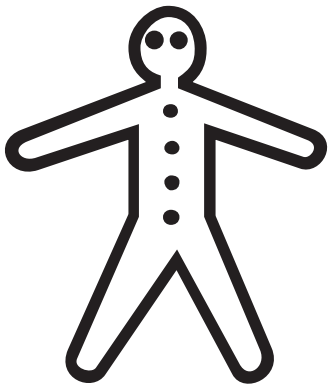

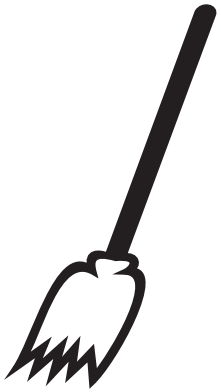

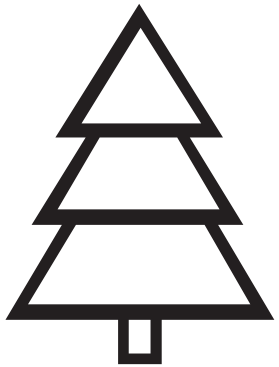

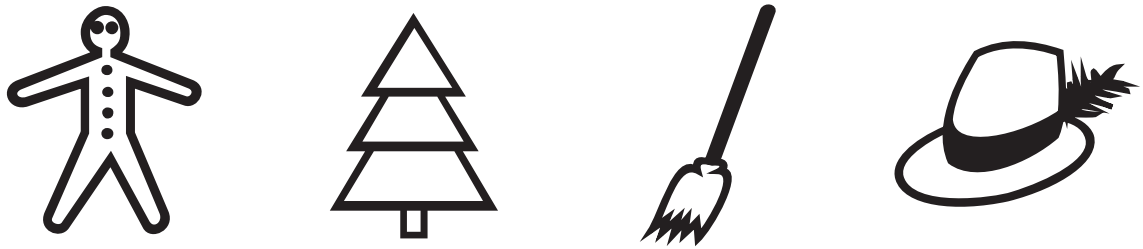

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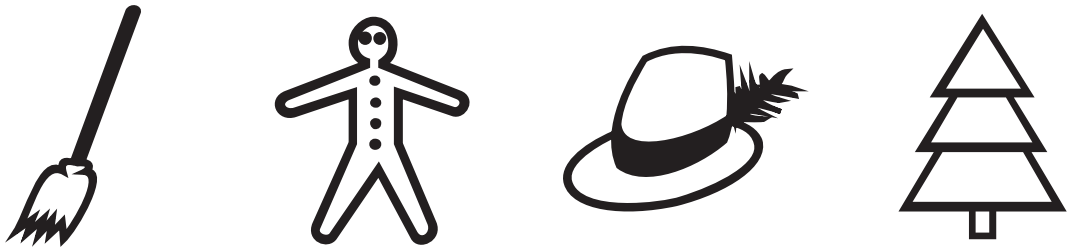

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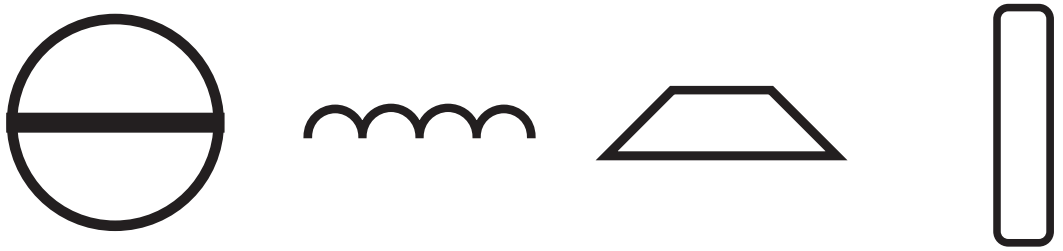

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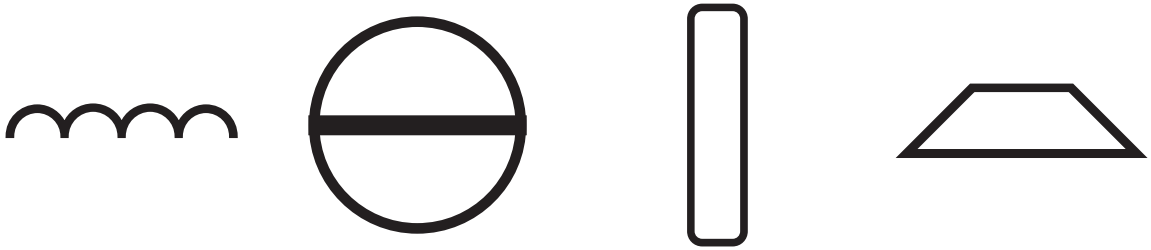

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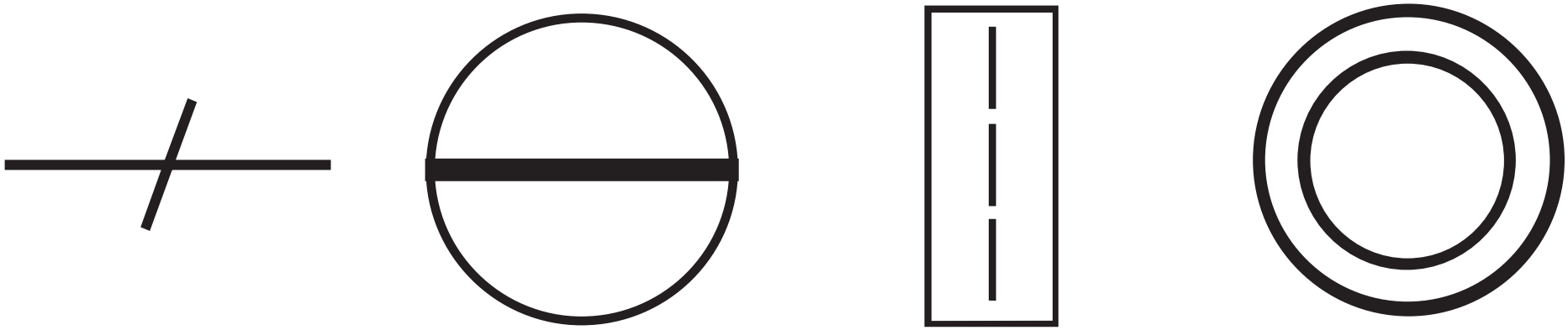

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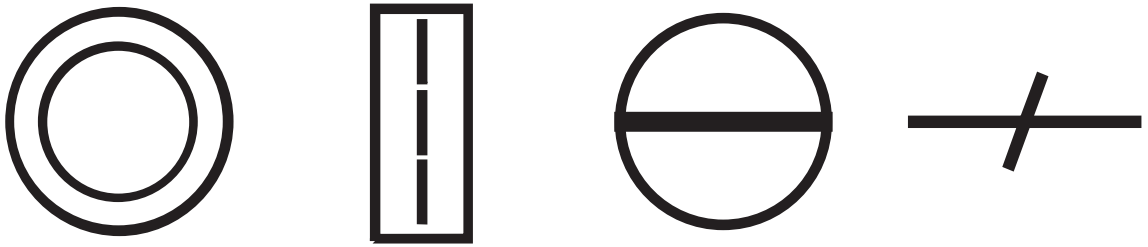

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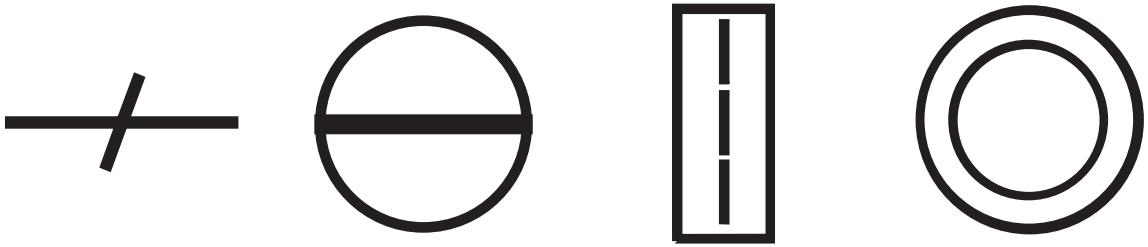

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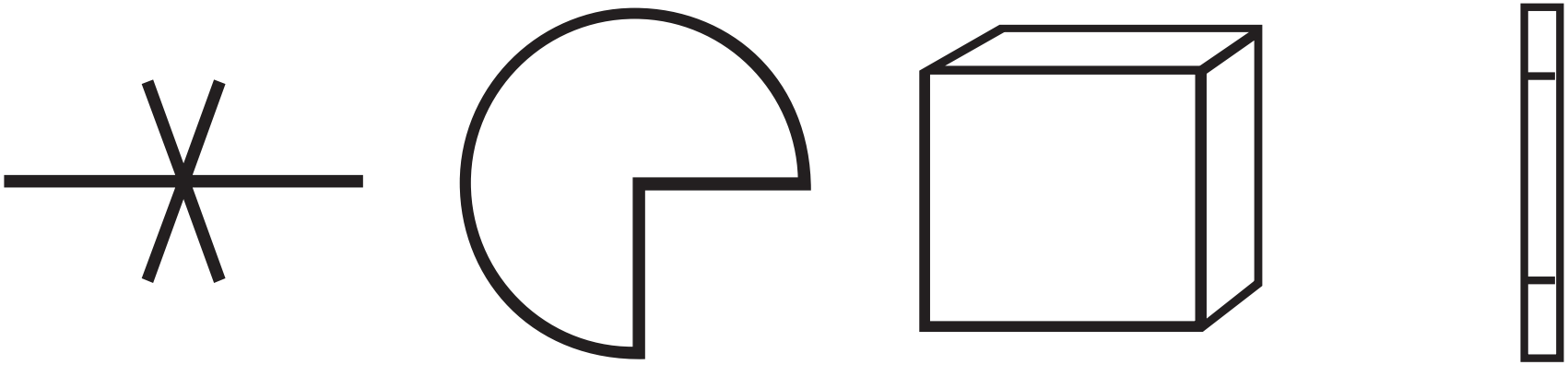

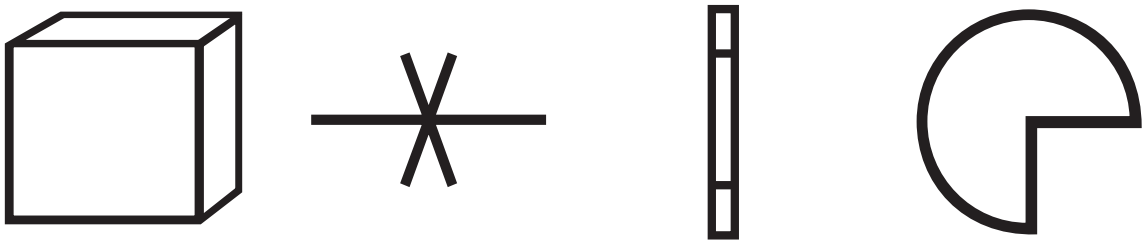

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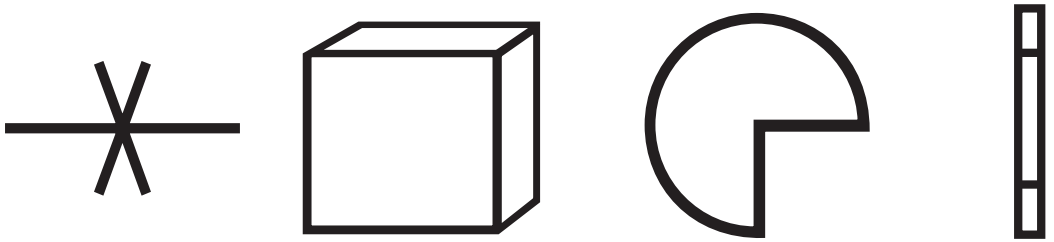

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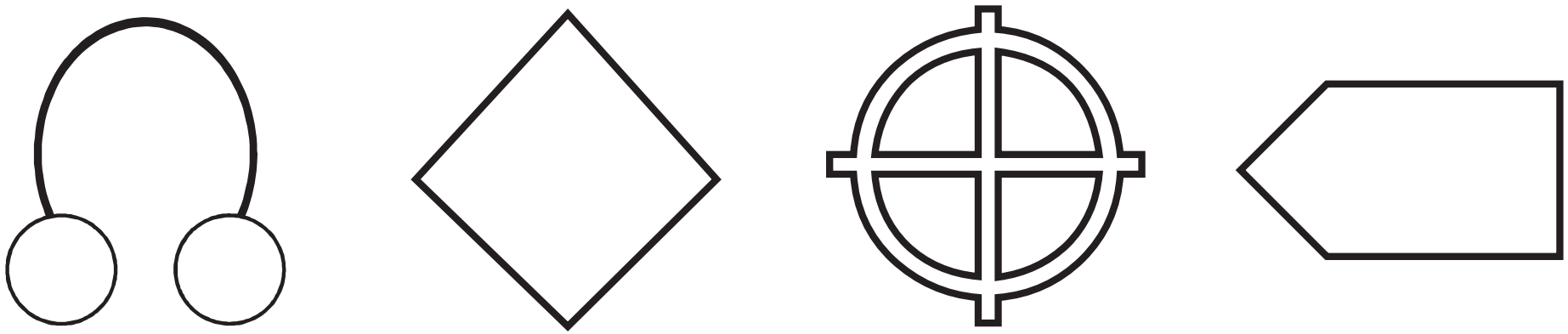

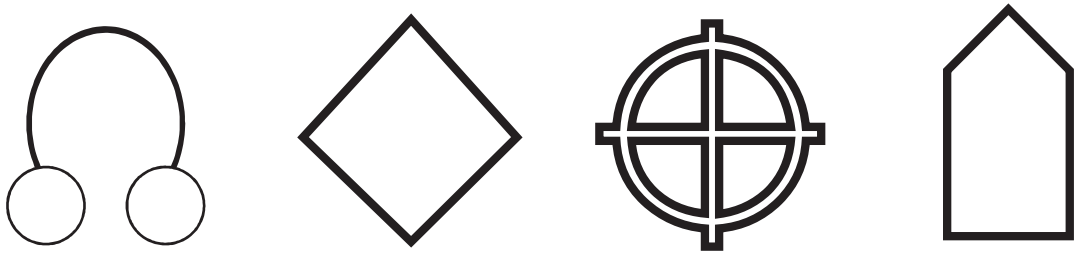

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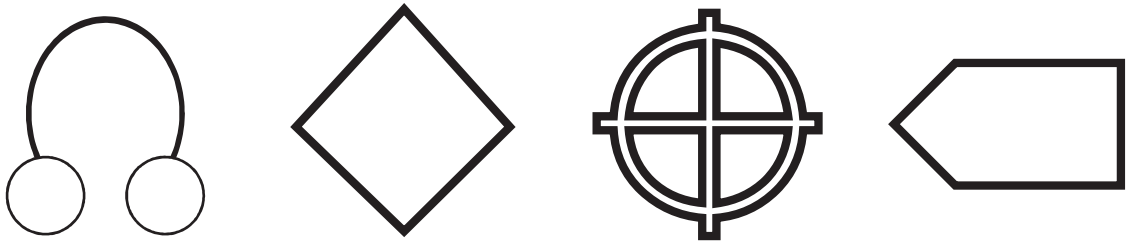

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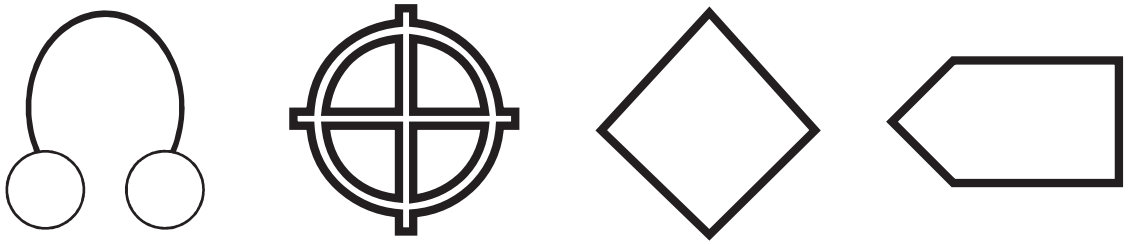

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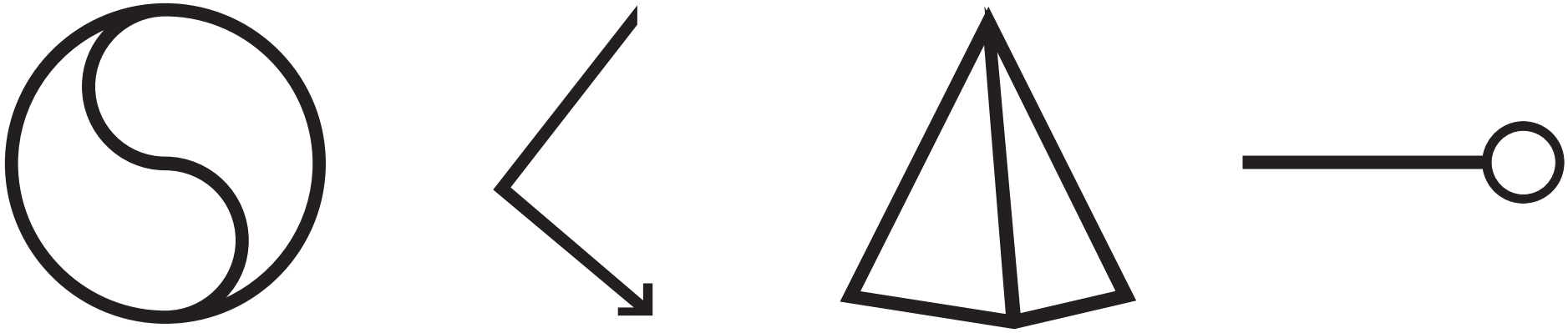

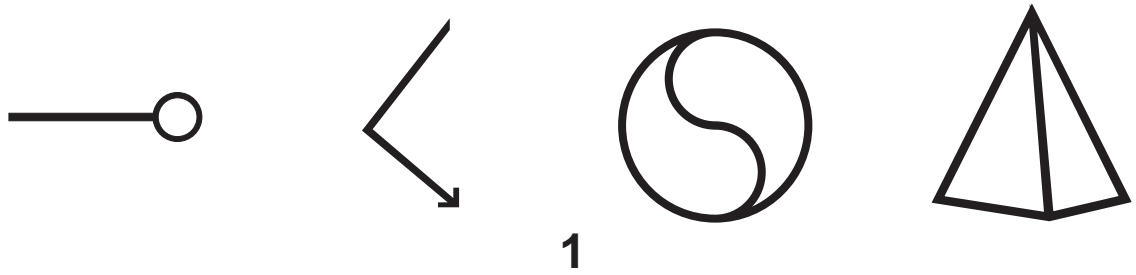

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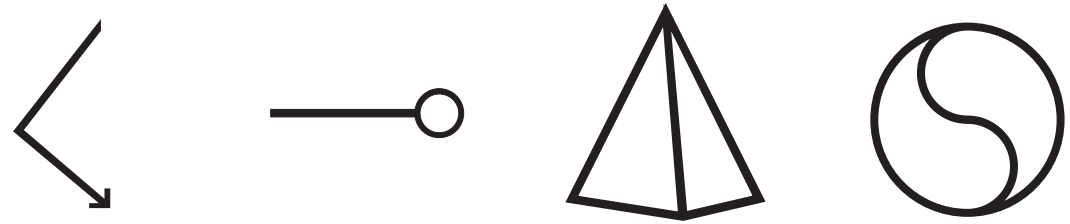

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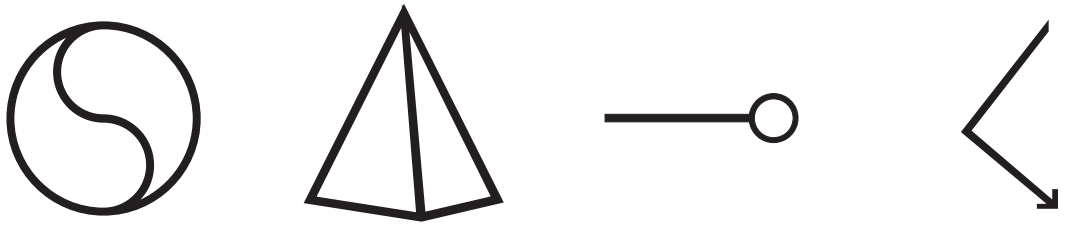

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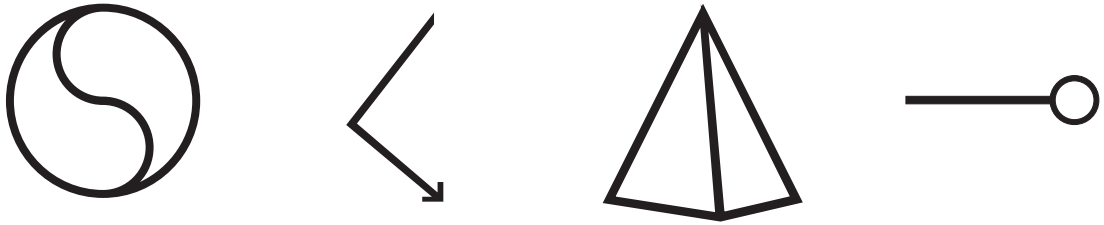

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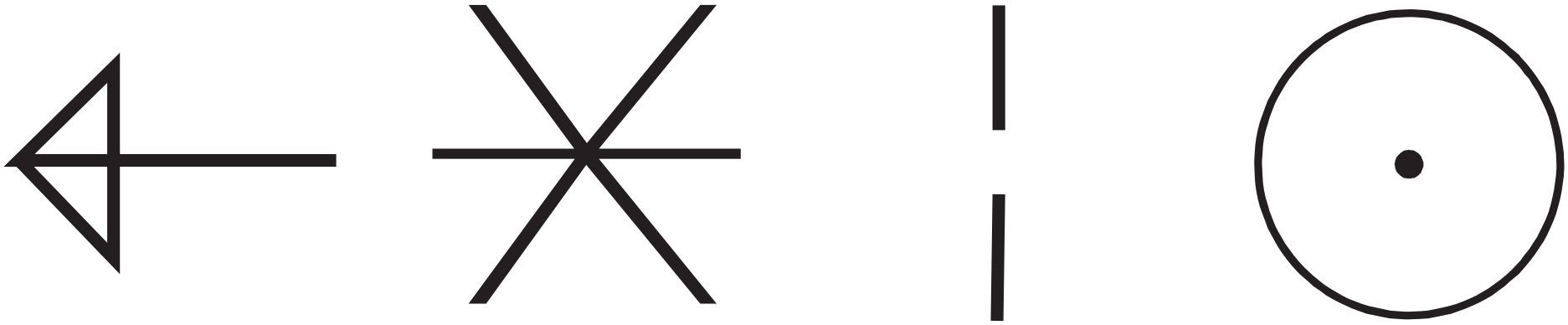

MVS - 70

1

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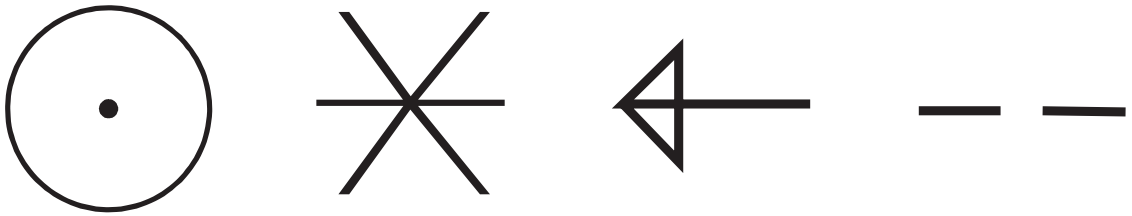

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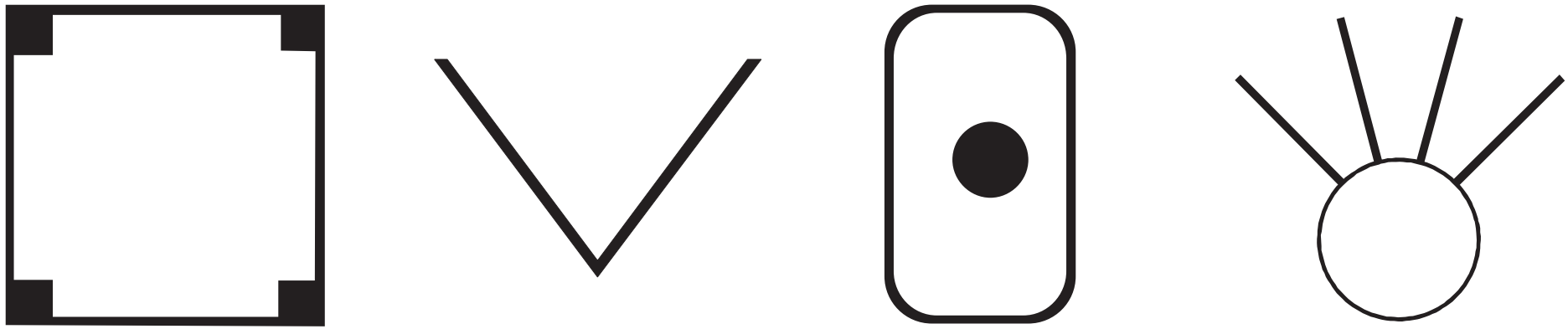

MVS - 71

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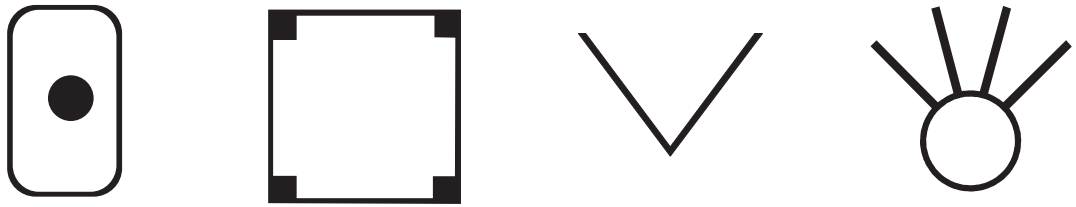

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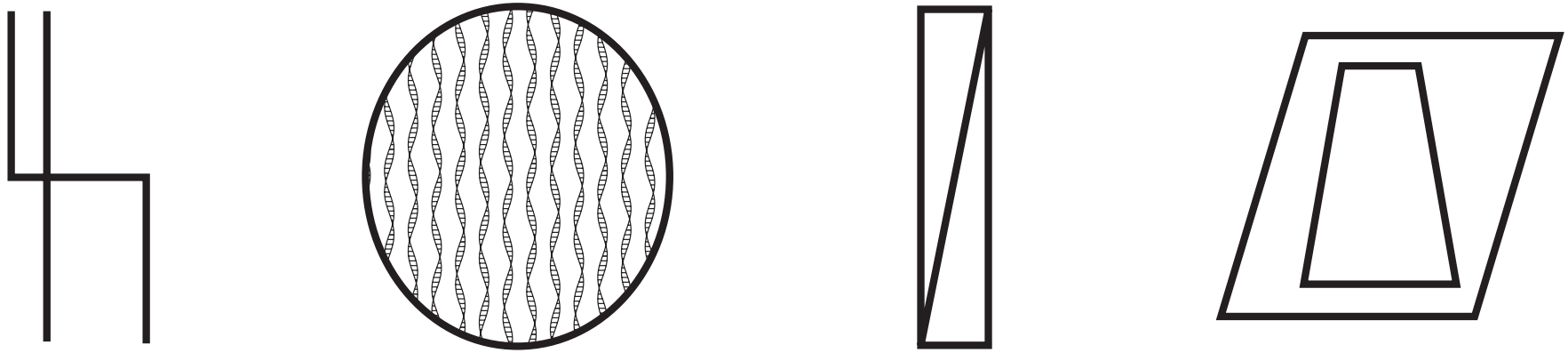
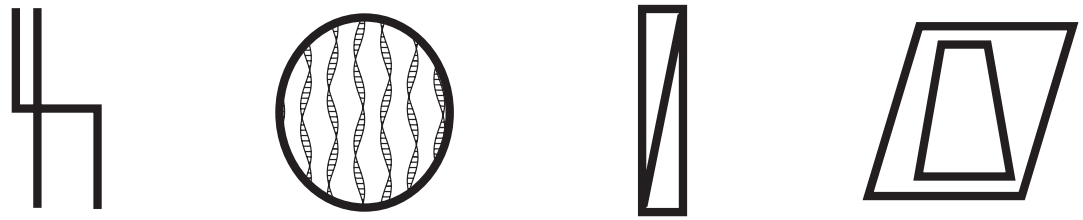
MVS - 72



MVS - 72

1



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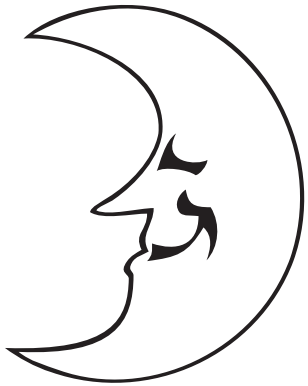
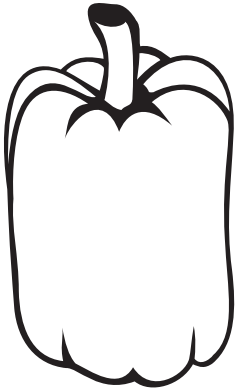


MVS - 73

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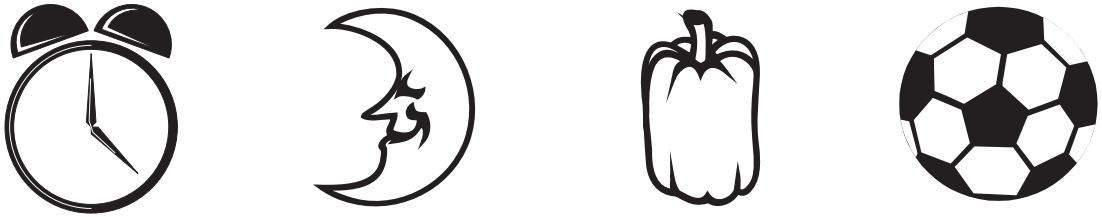

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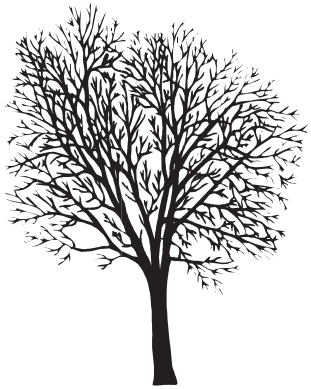
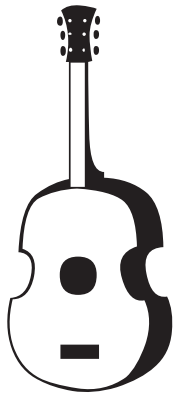
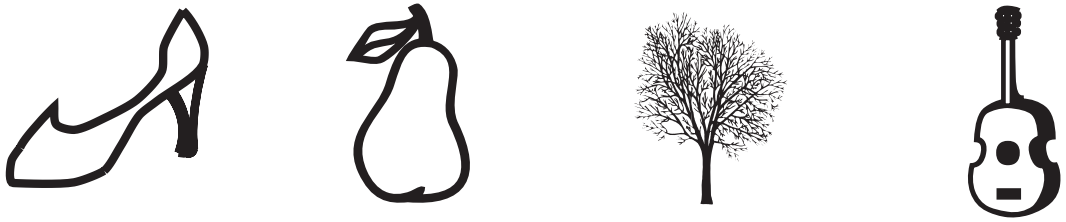
MVS - 74





MVS - 74



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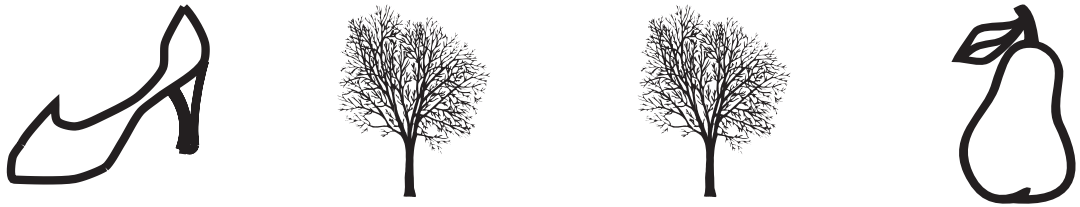

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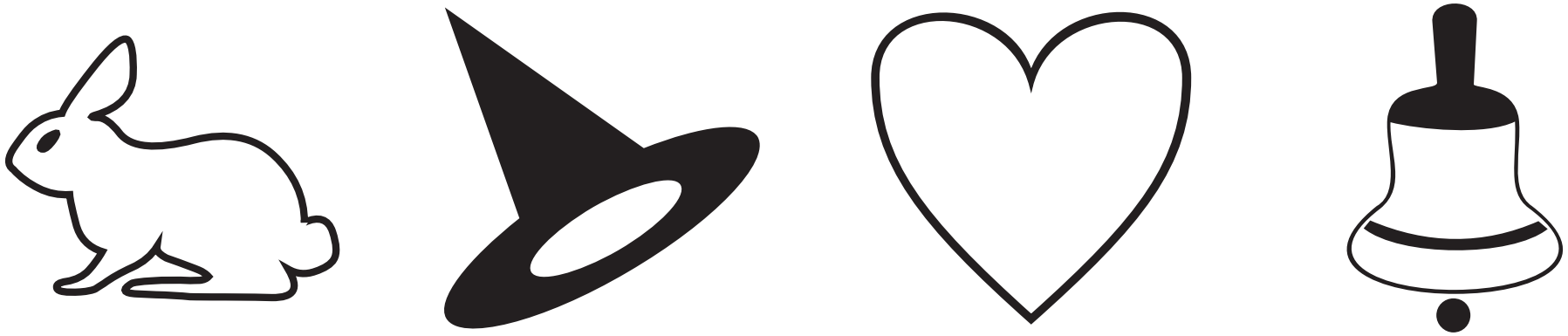
4

MVS - 75



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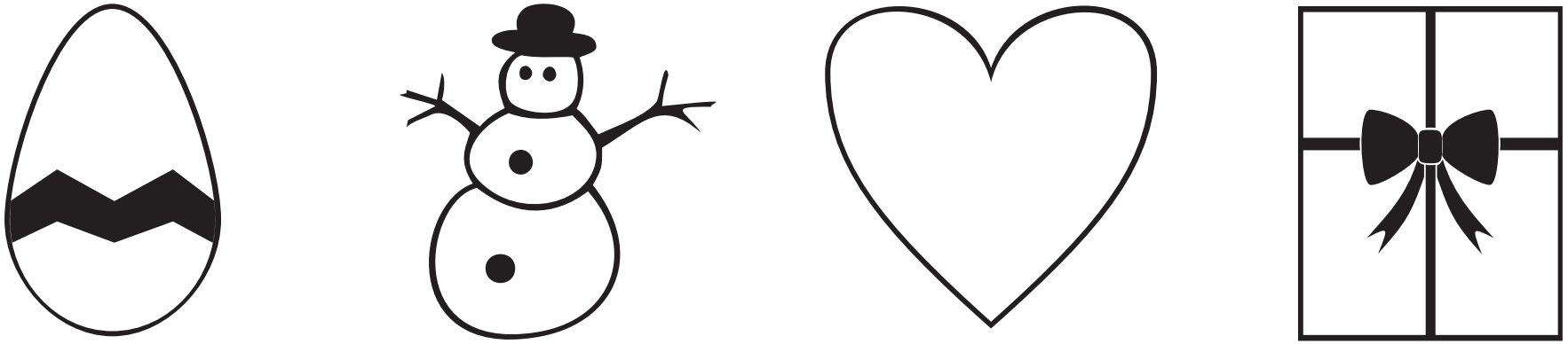

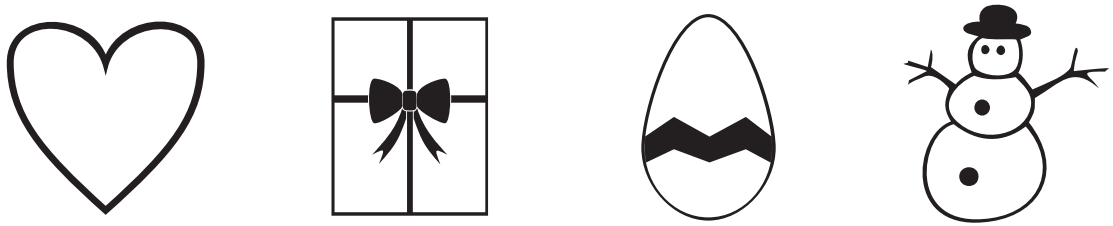

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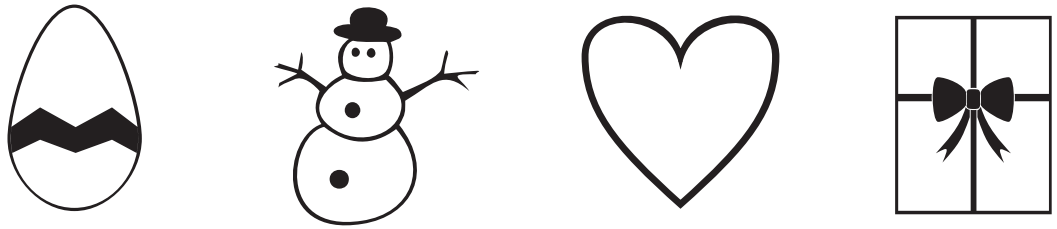

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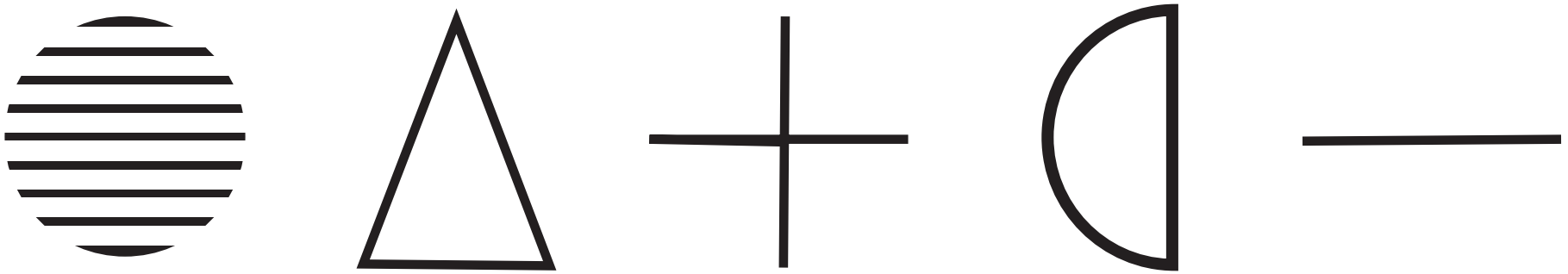

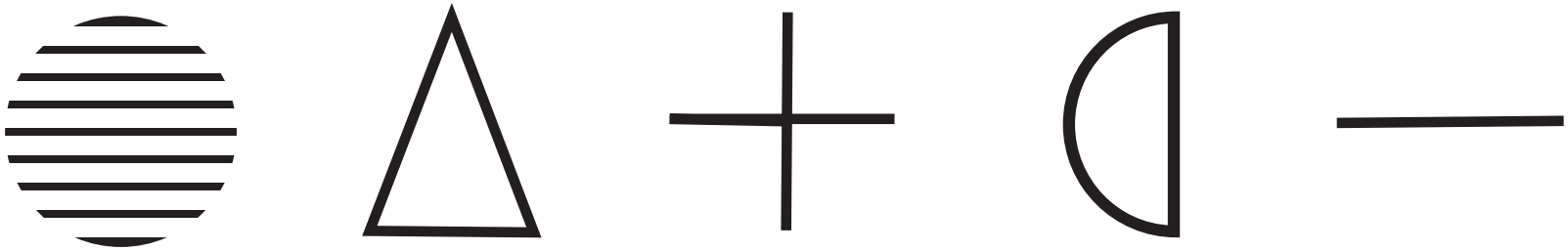

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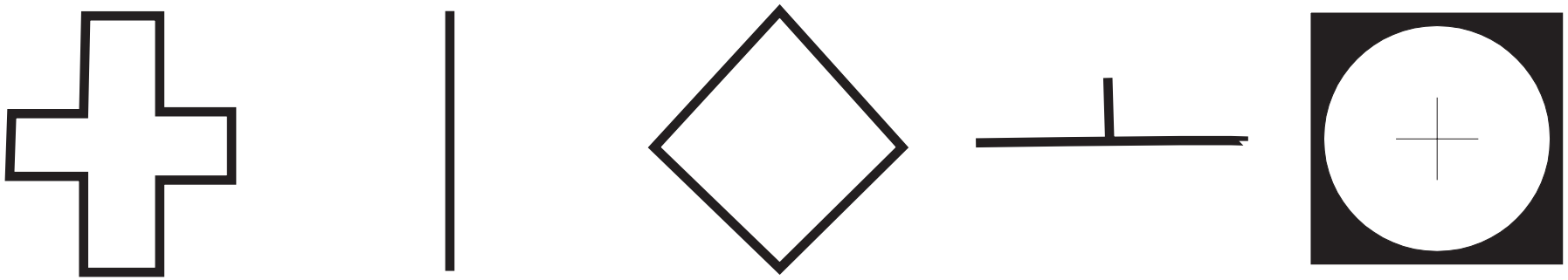

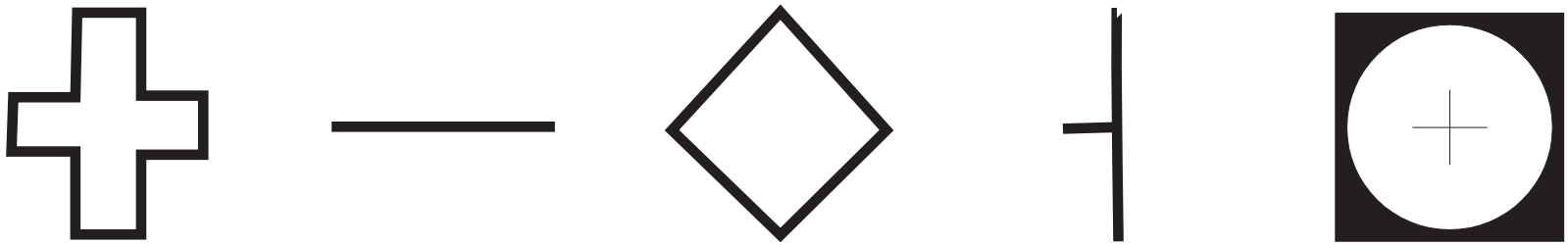

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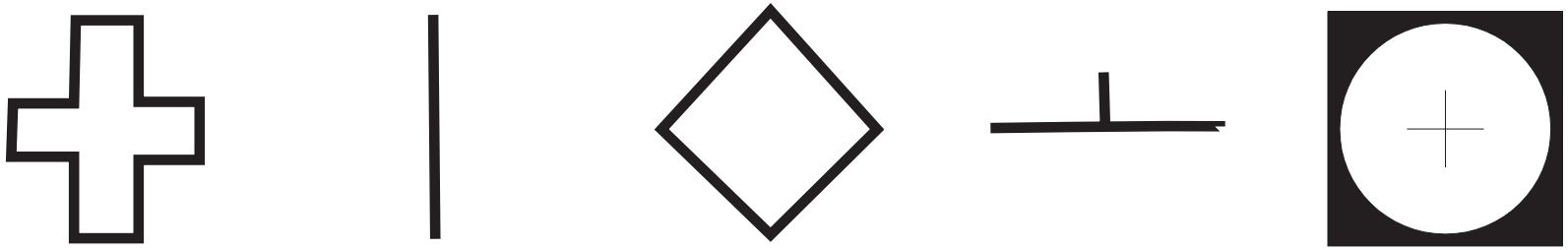

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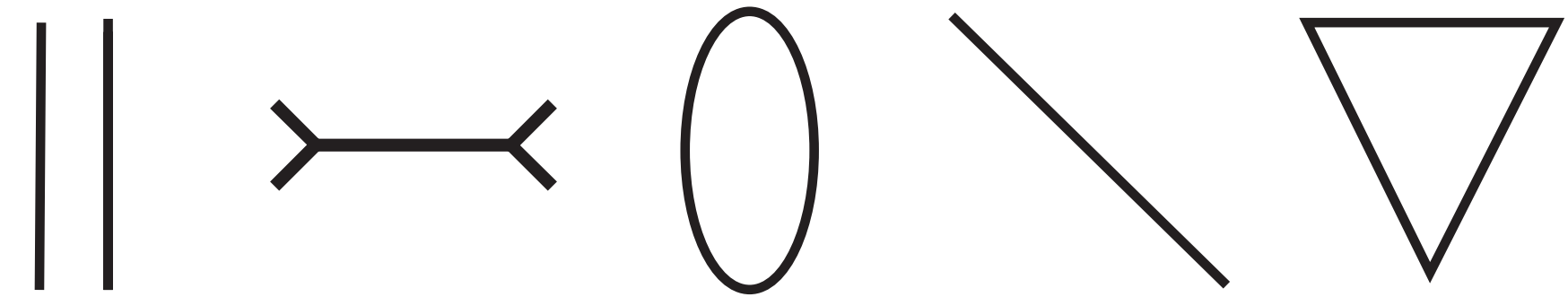

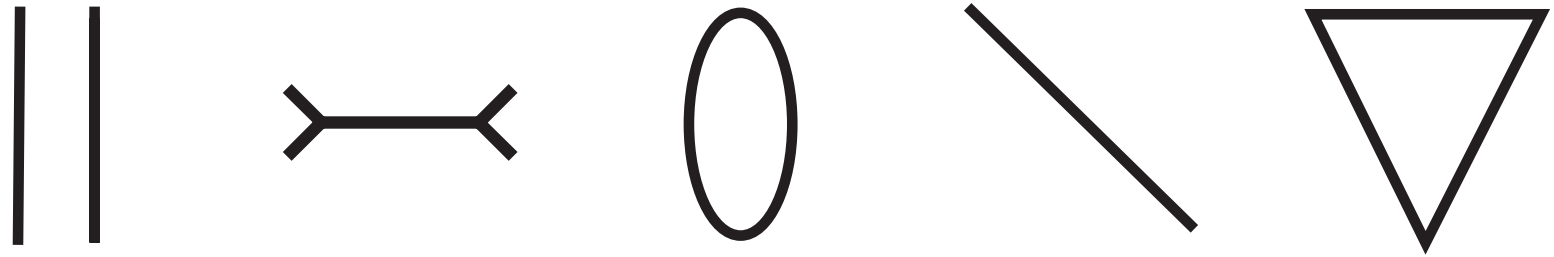

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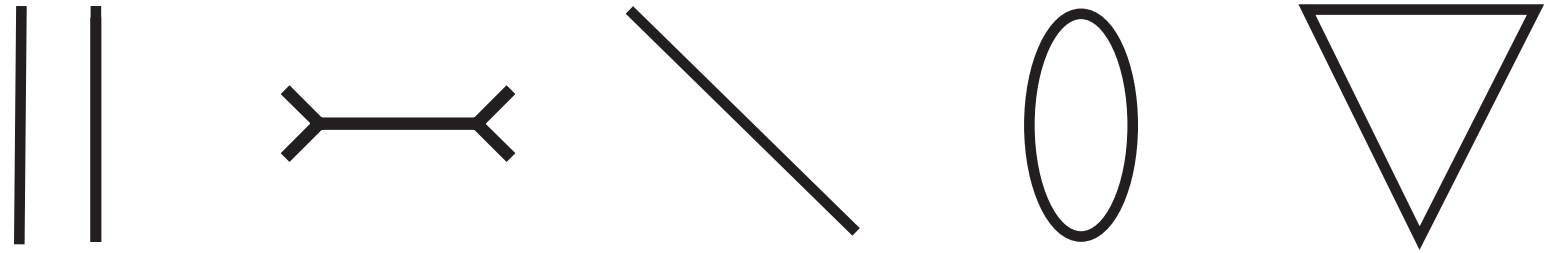
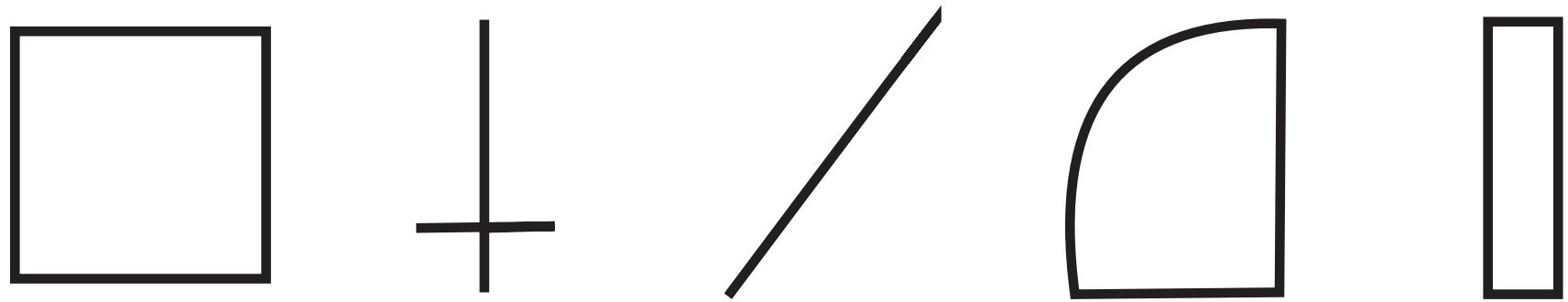


2

MVS - 80



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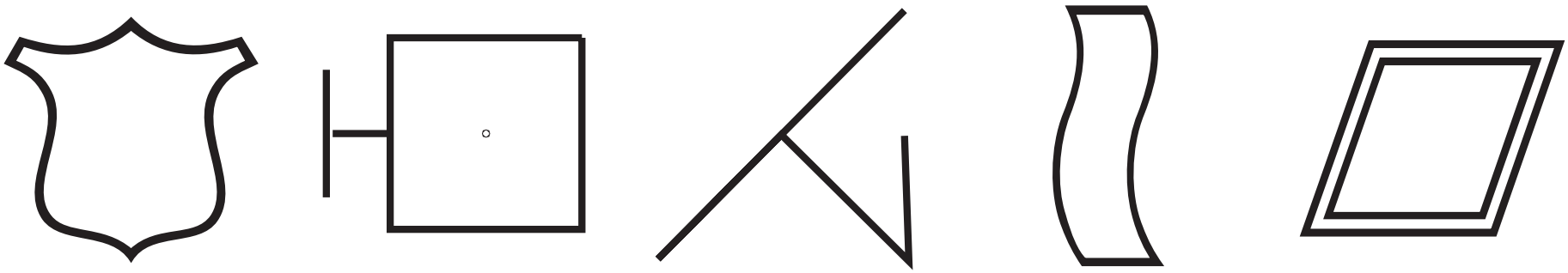

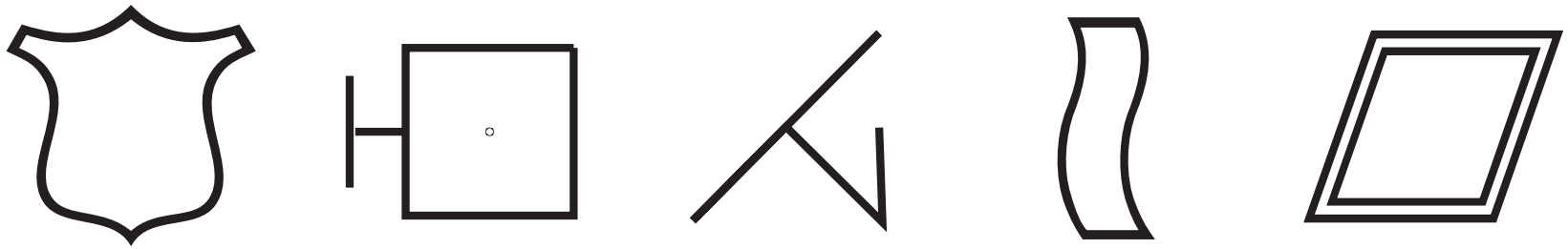

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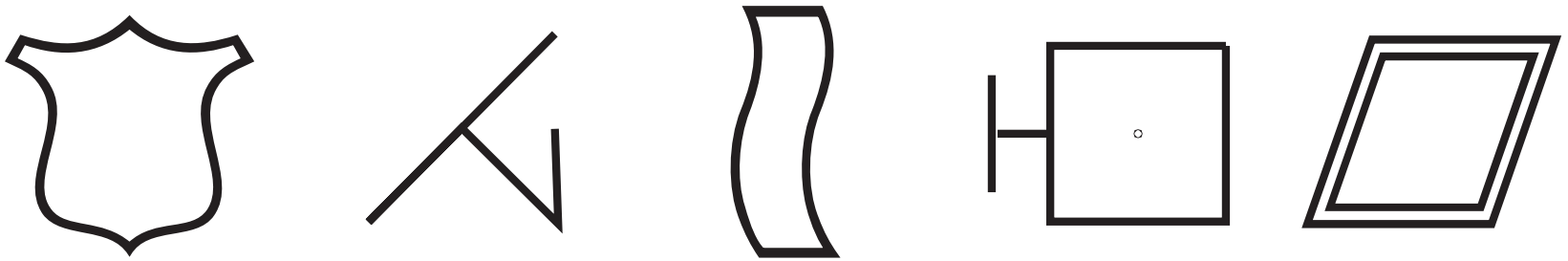

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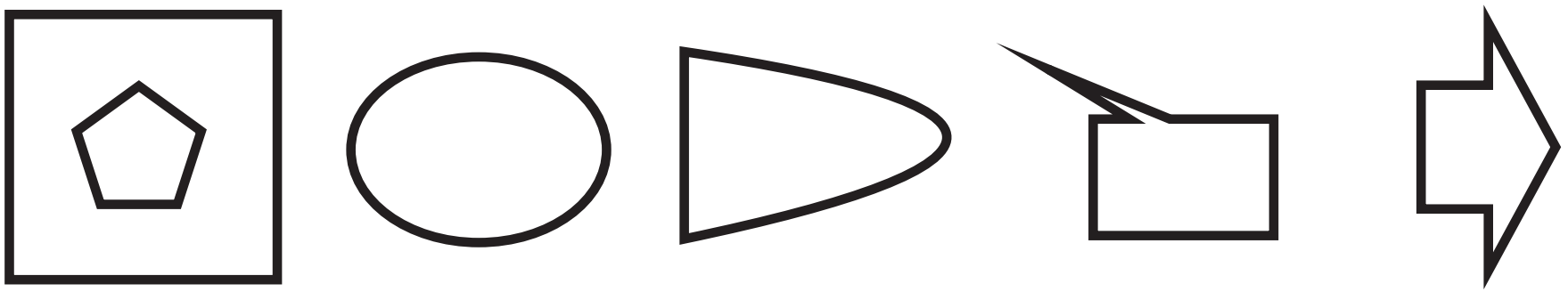

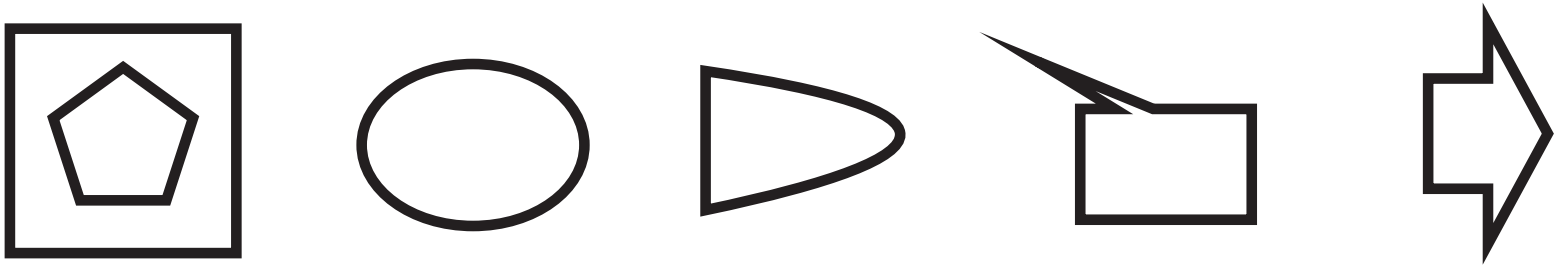

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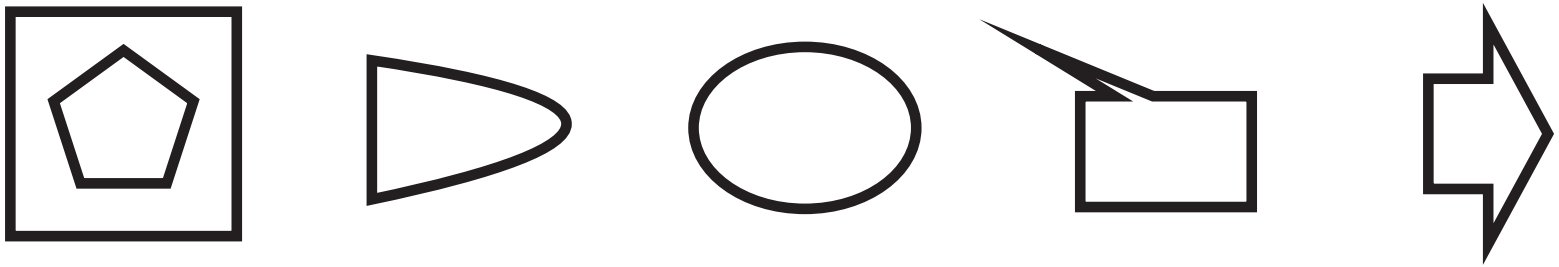

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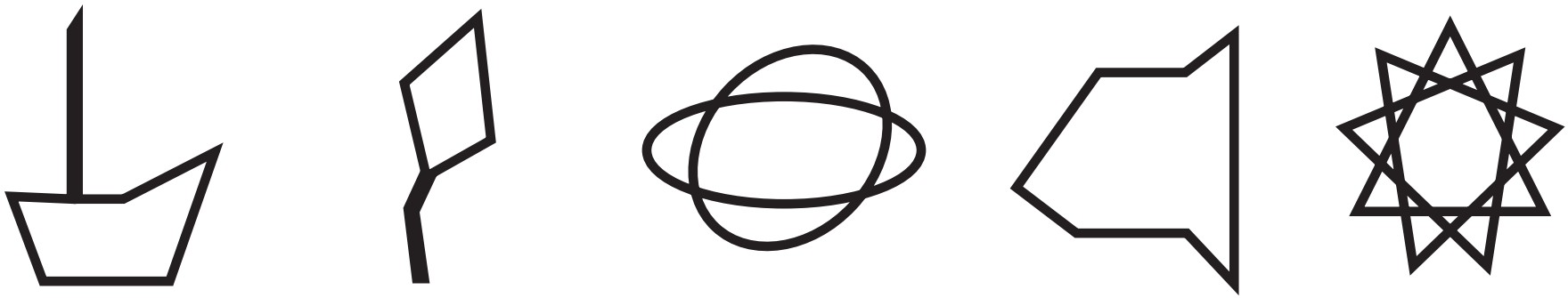

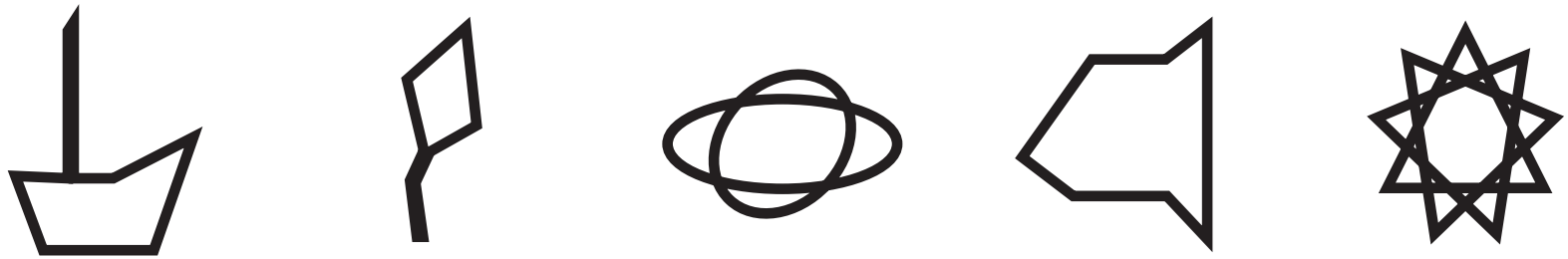

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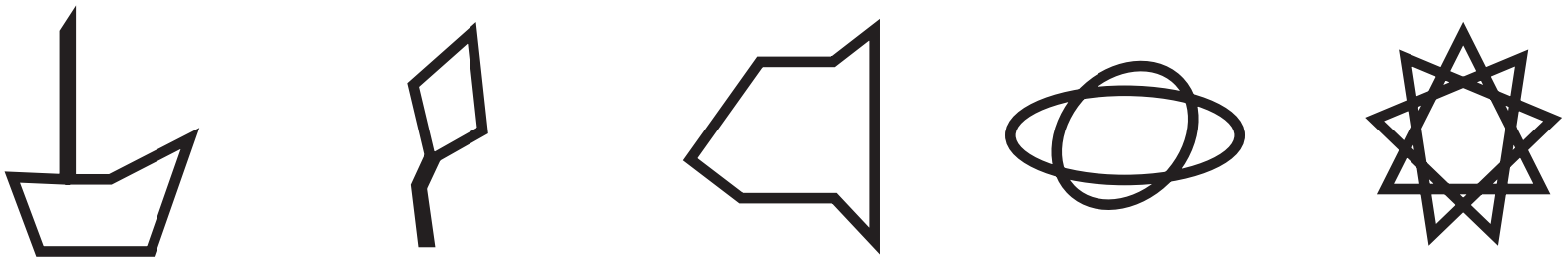
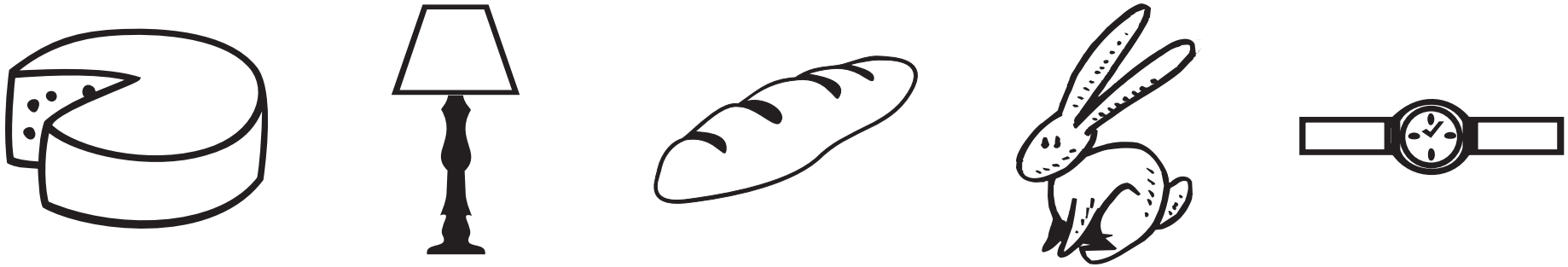
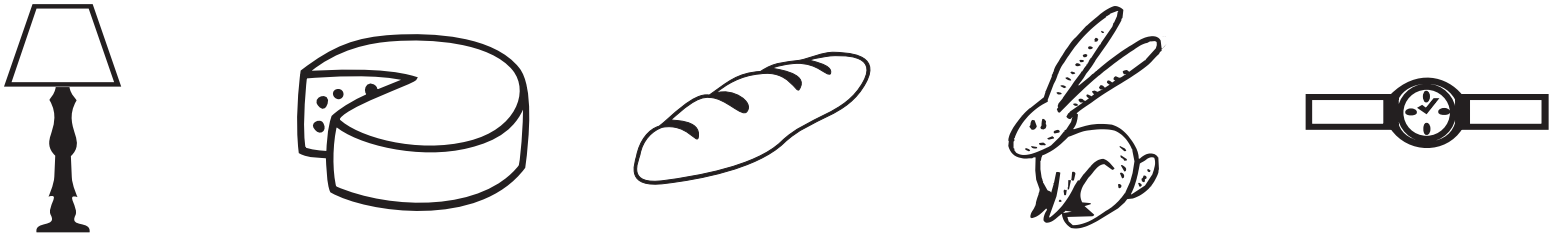


2

MVS - 84





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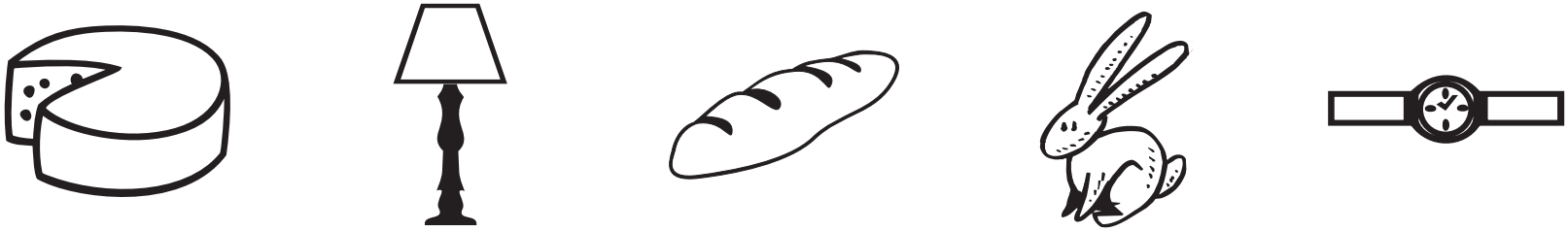

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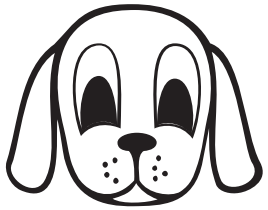
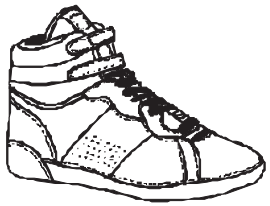
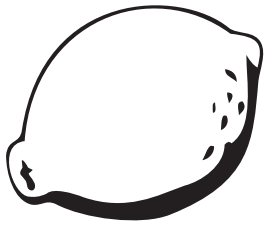

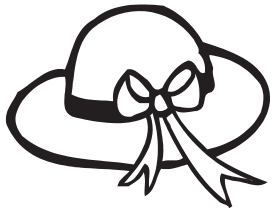

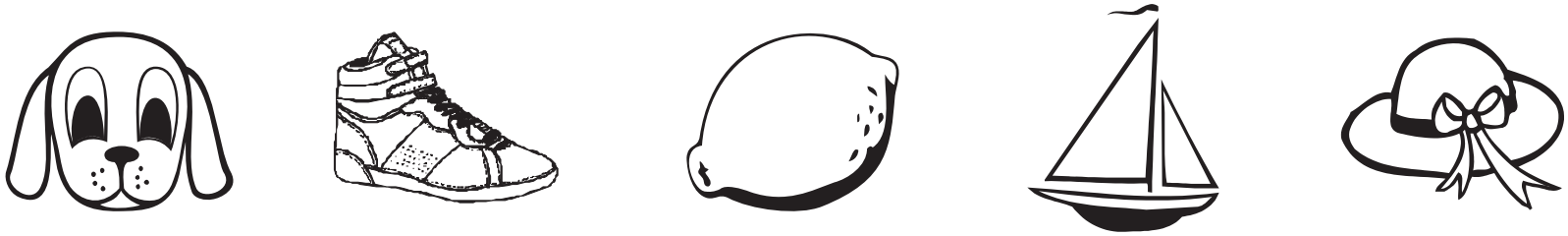

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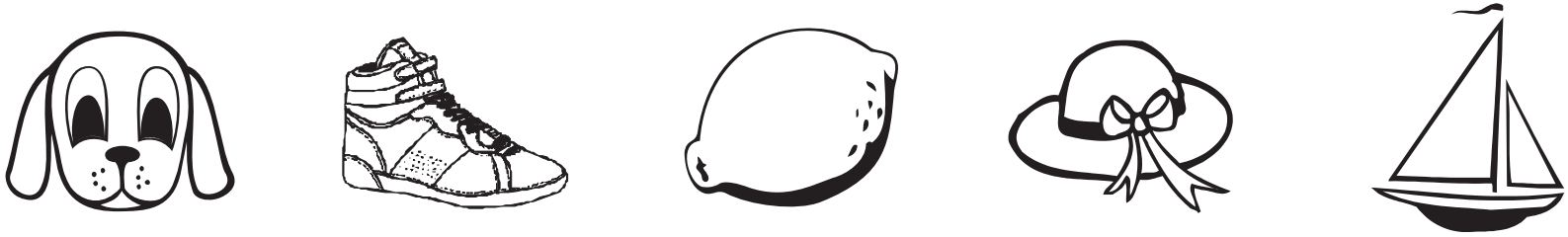
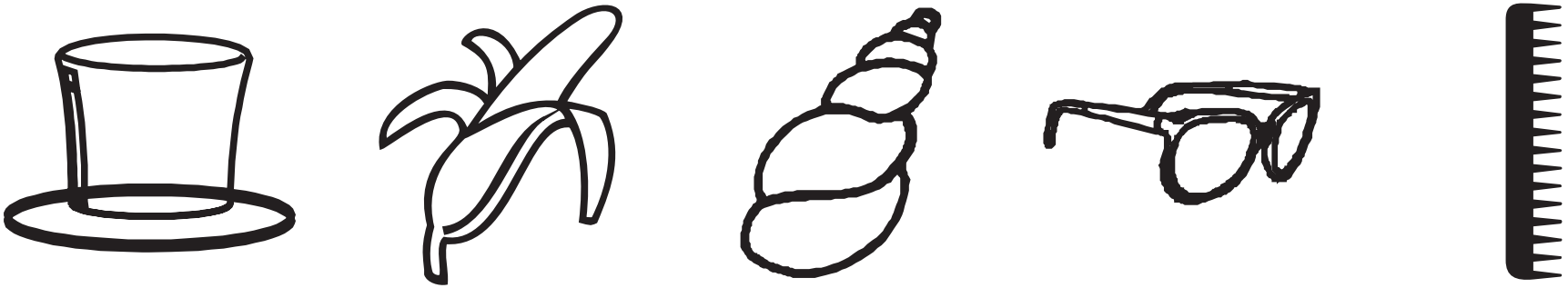
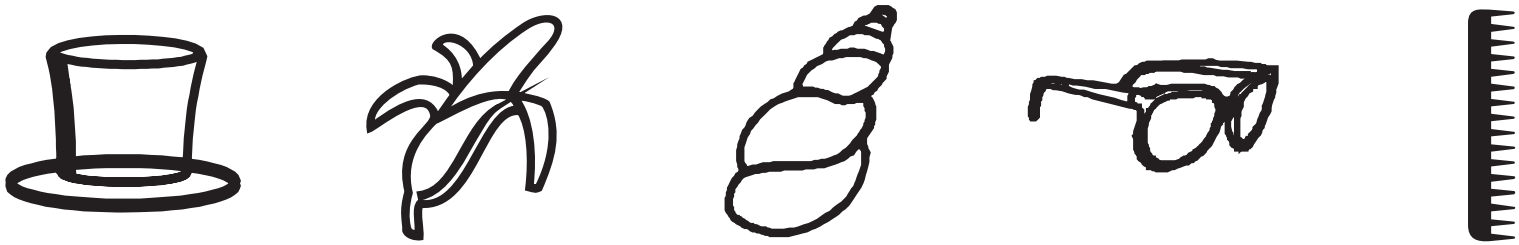


2

MVS - 86





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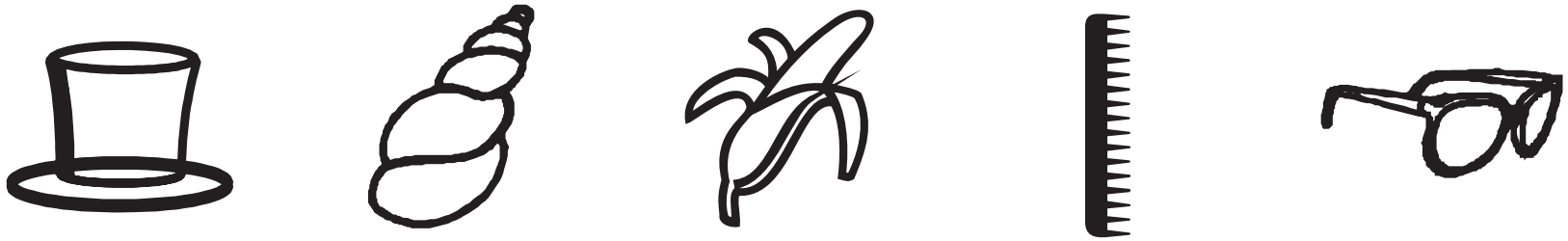

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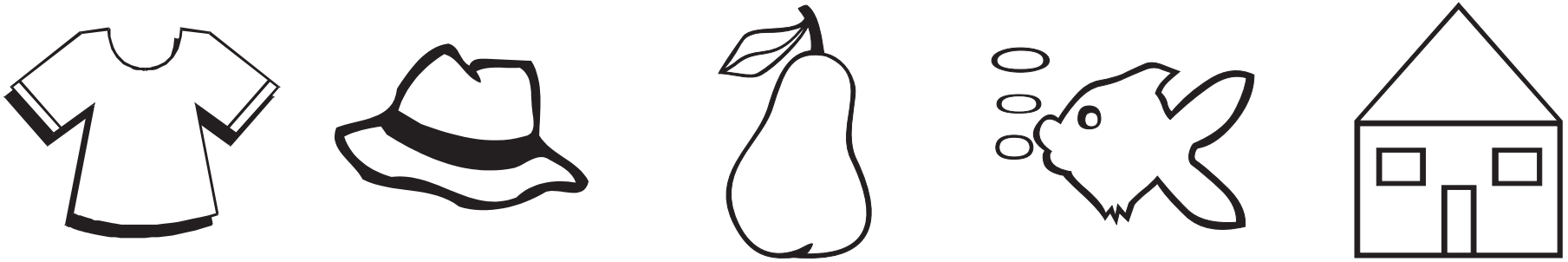

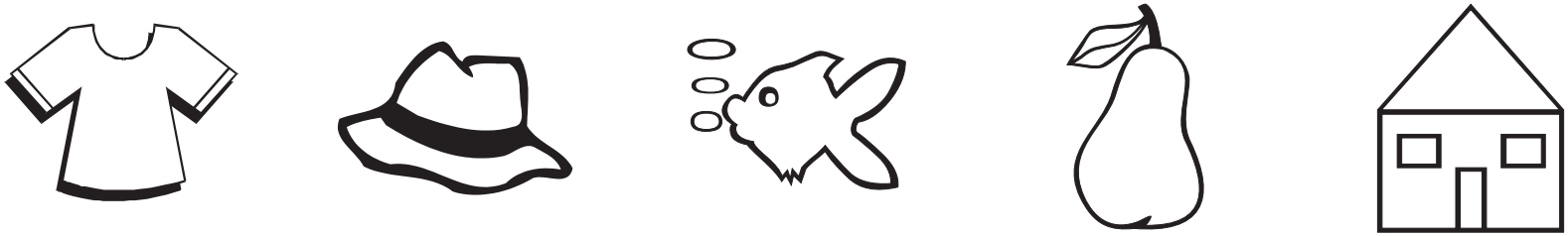

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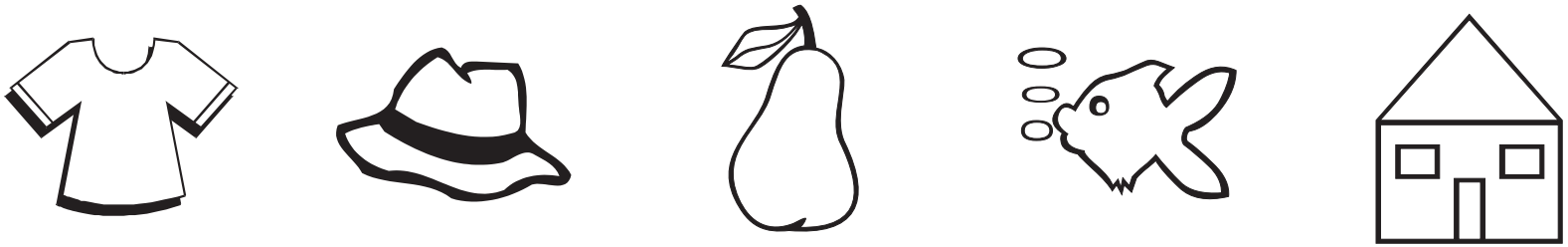


2

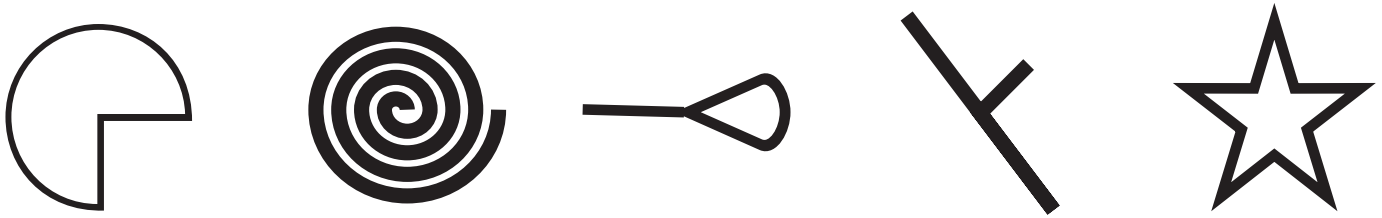
MVS - 88

1

2

1

2



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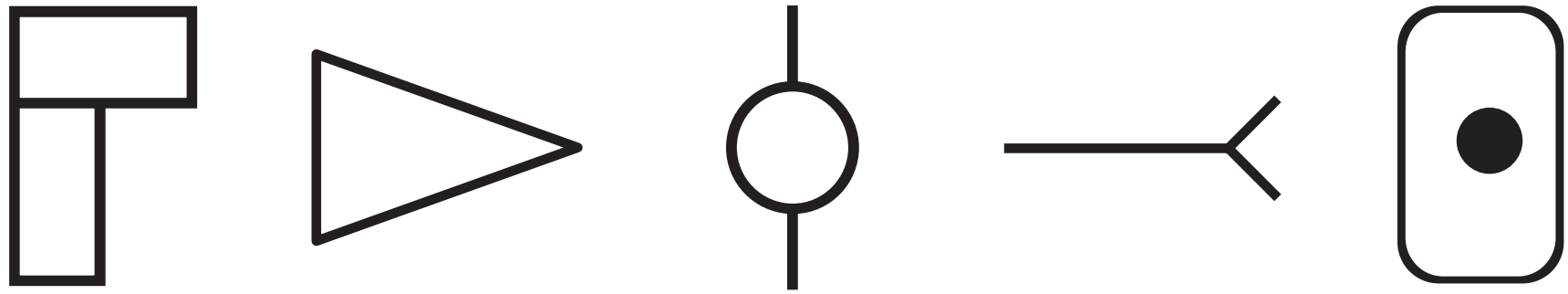

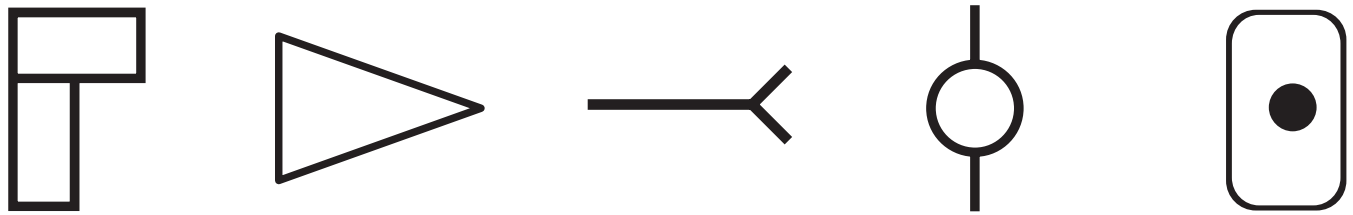

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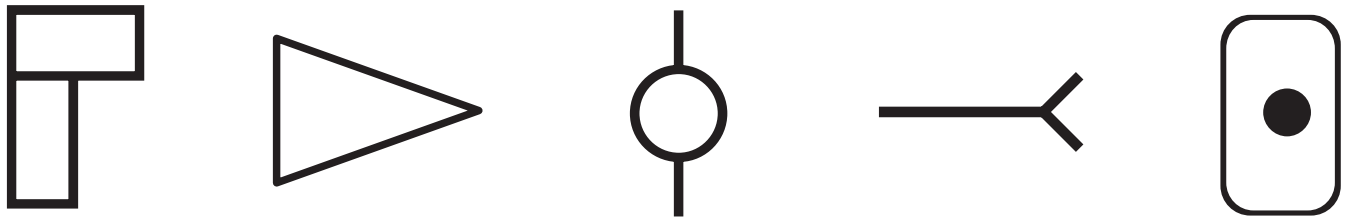

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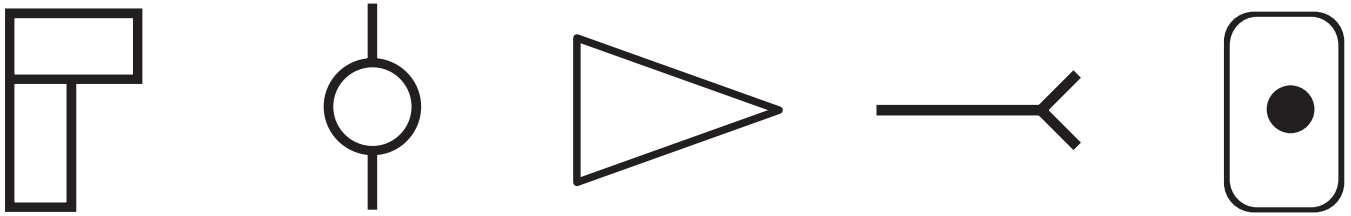

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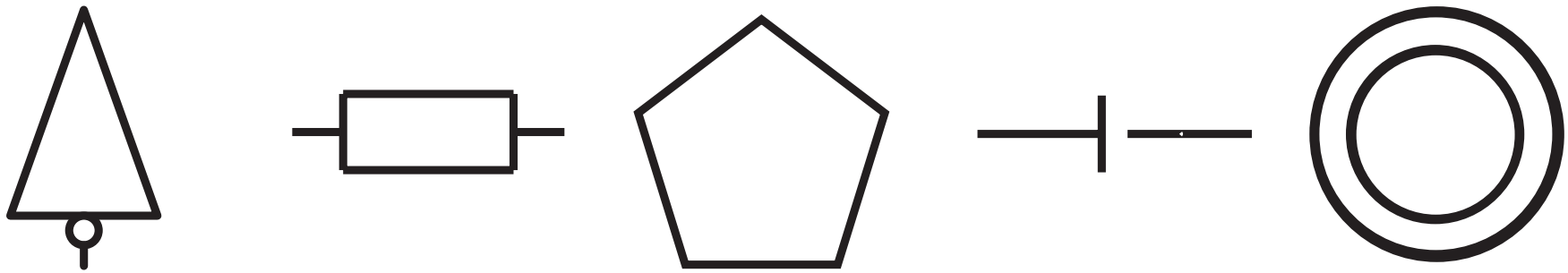

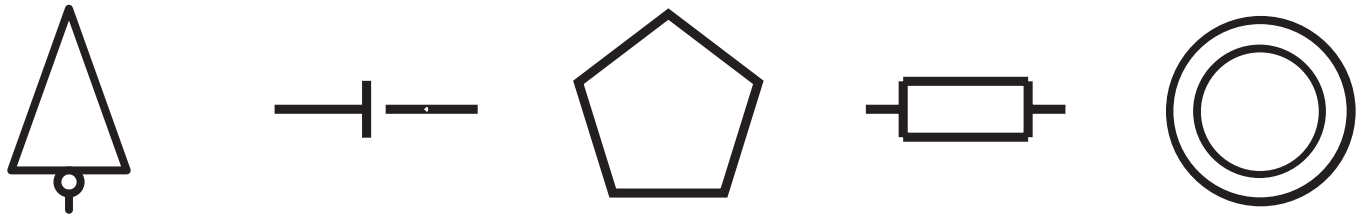

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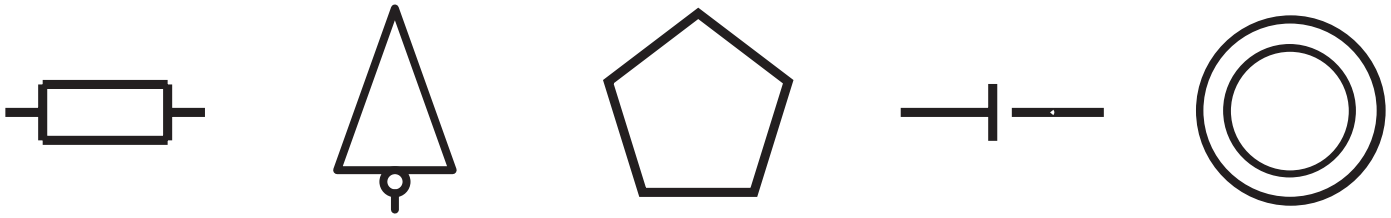

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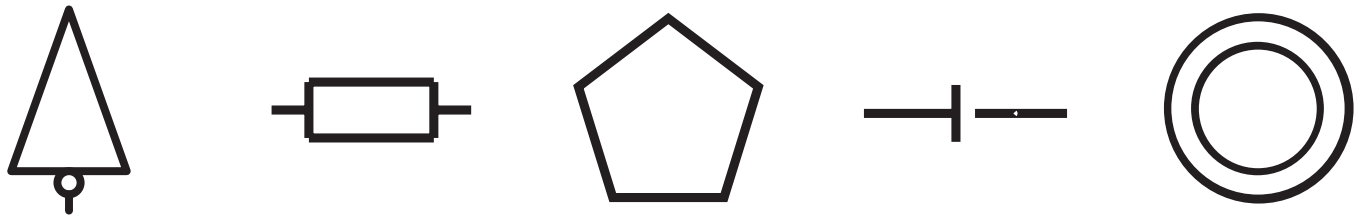

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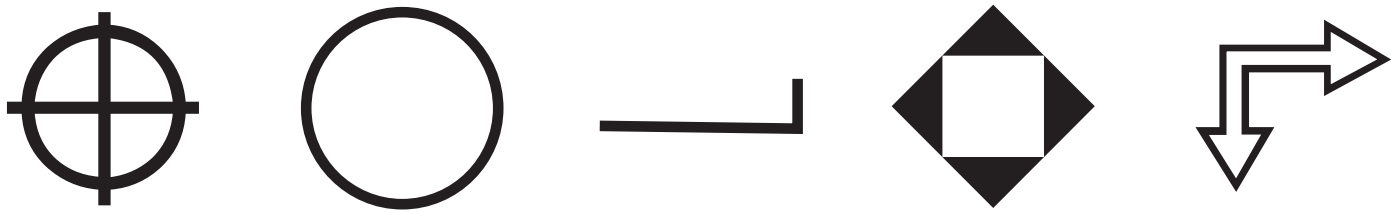

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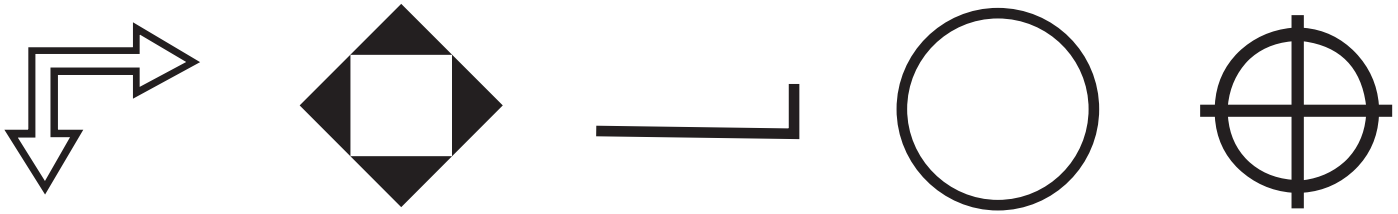

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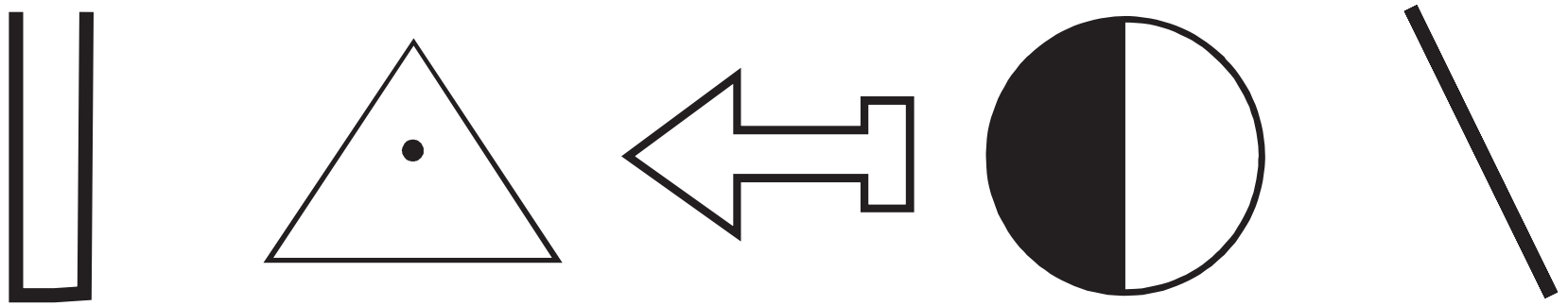

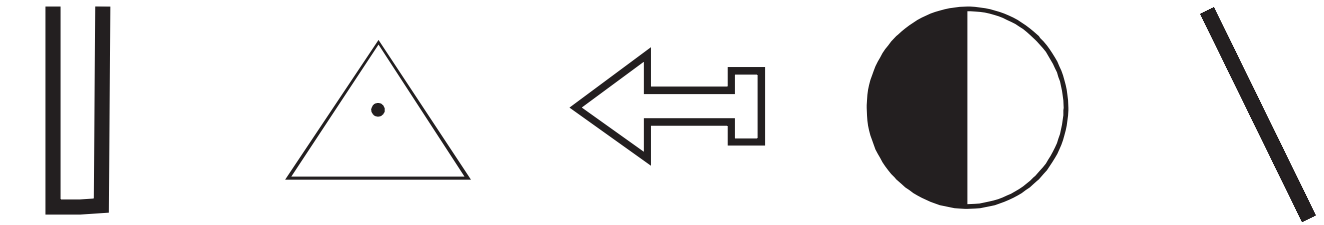

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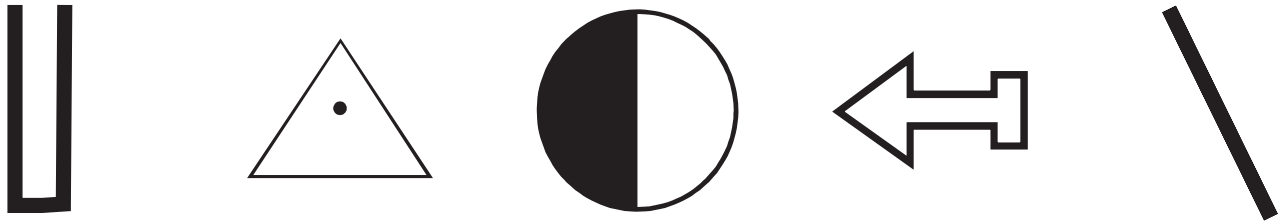

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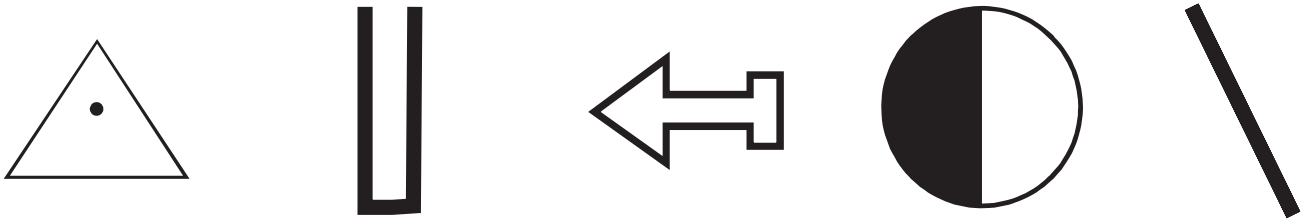


3

MVS - 94

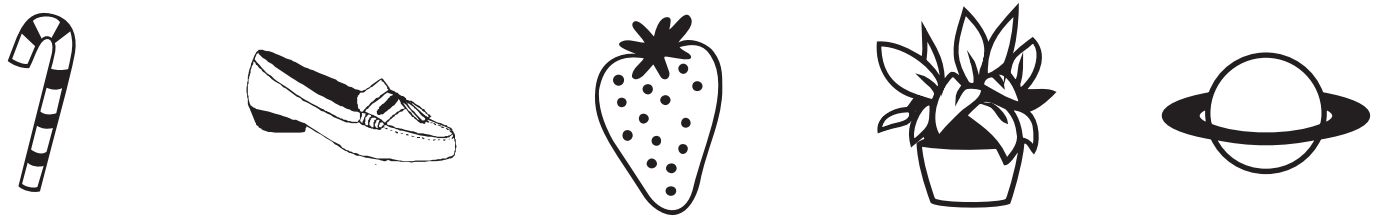
1

2

3

1

2



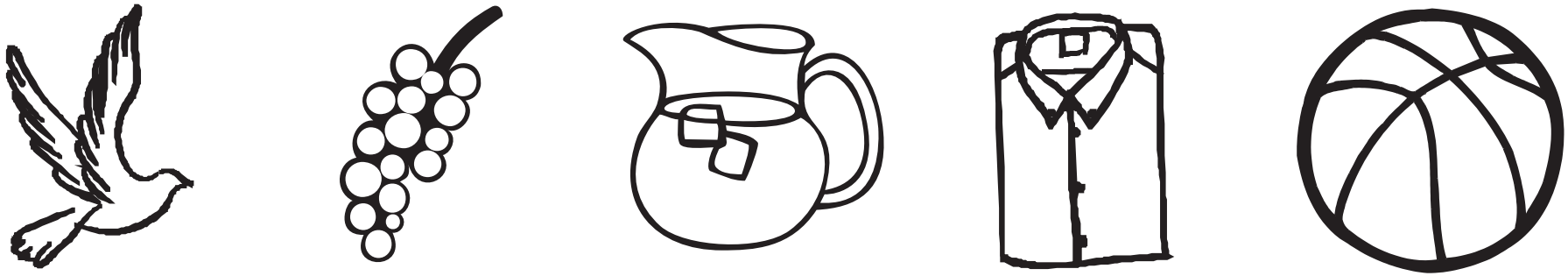
3

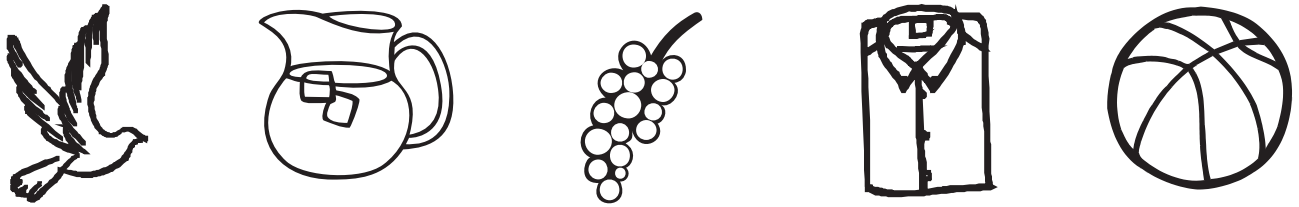
MVS - 96

1

2

3





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2

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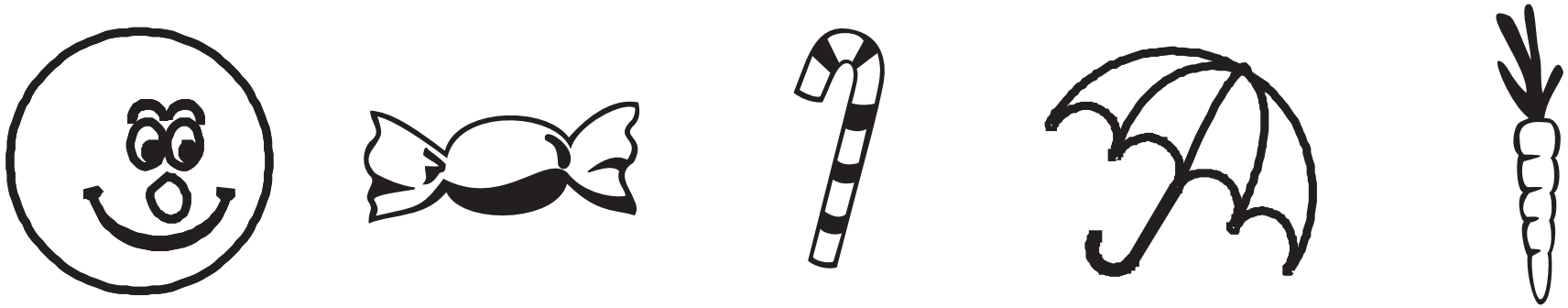

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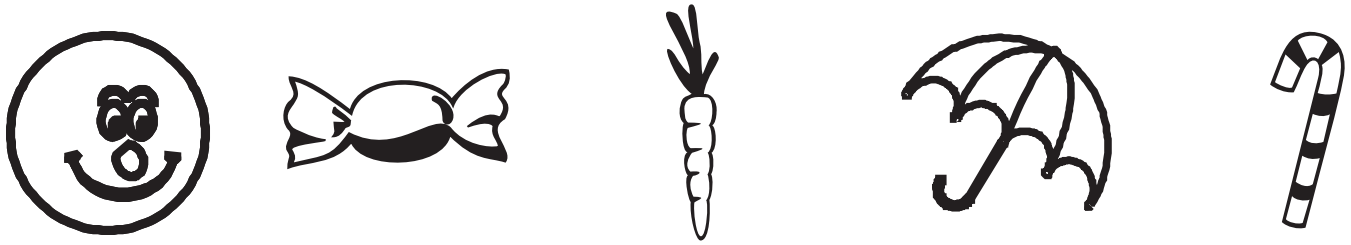

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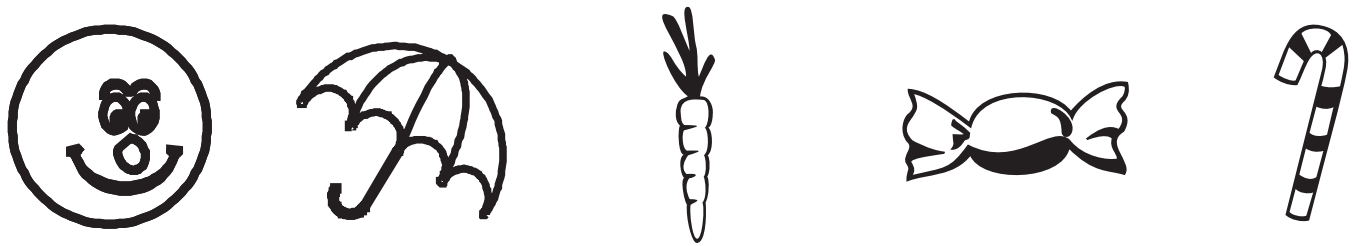

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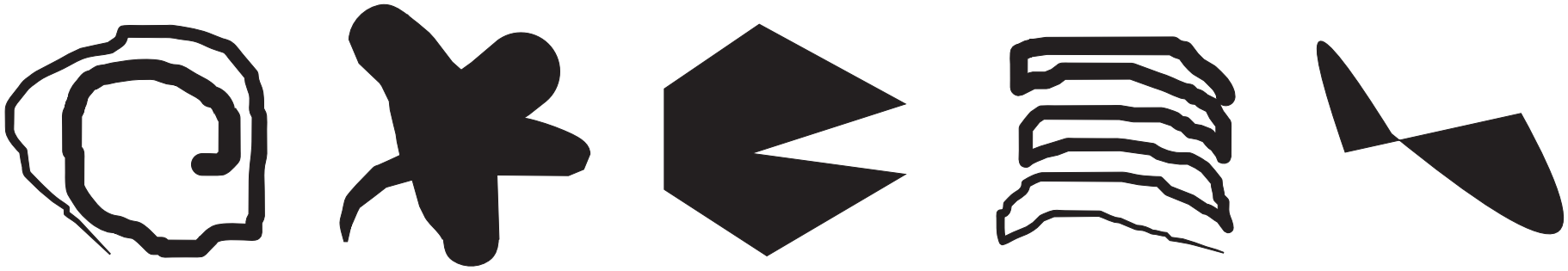

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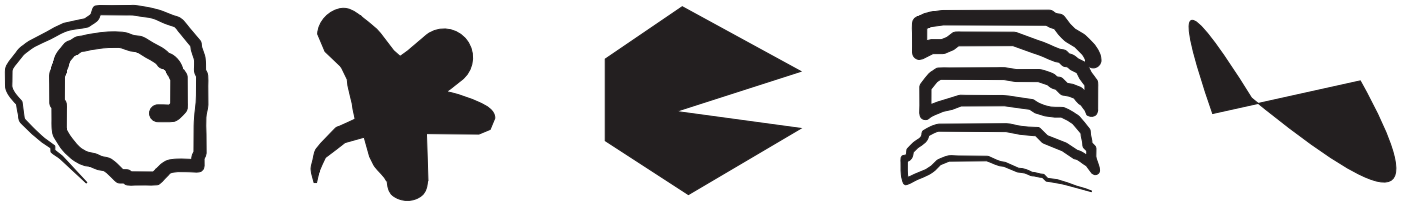

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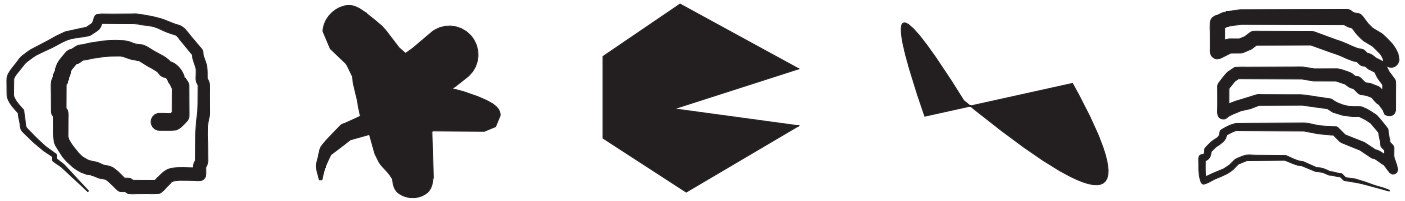

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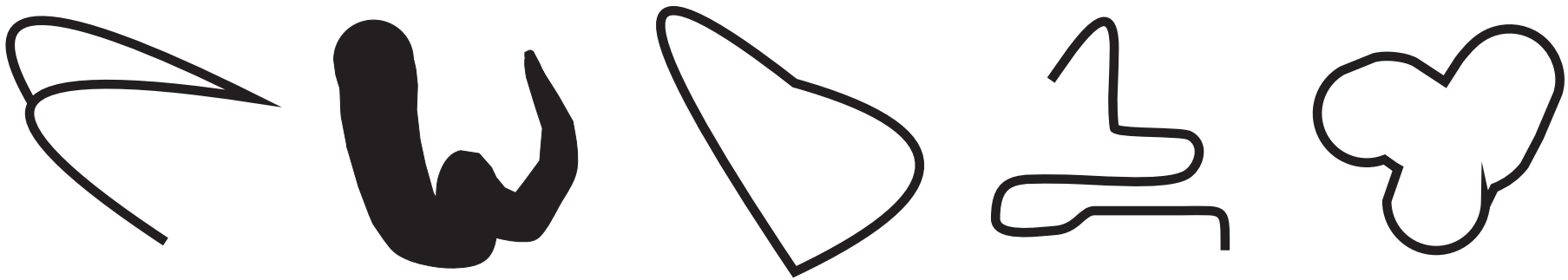

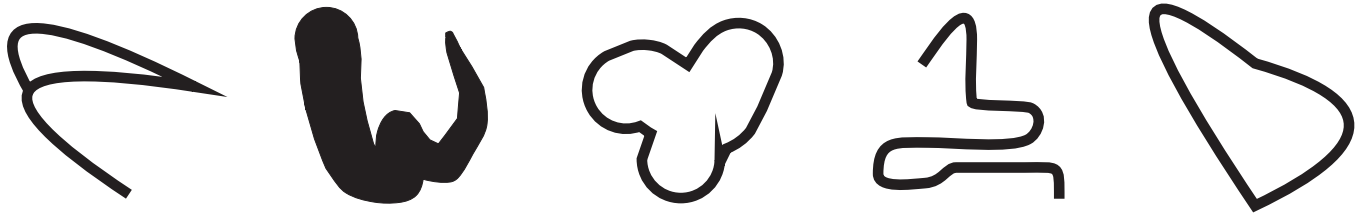

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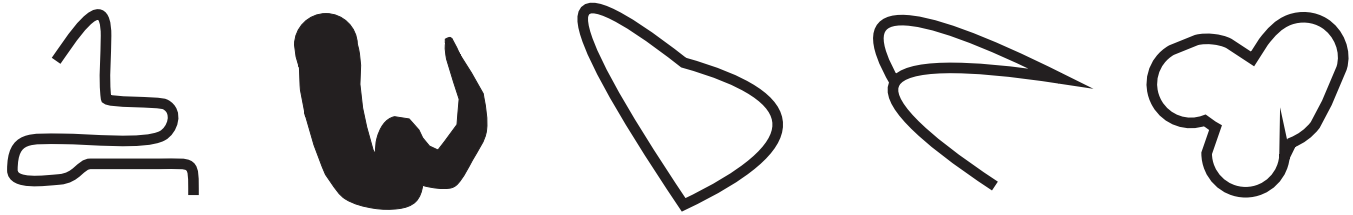

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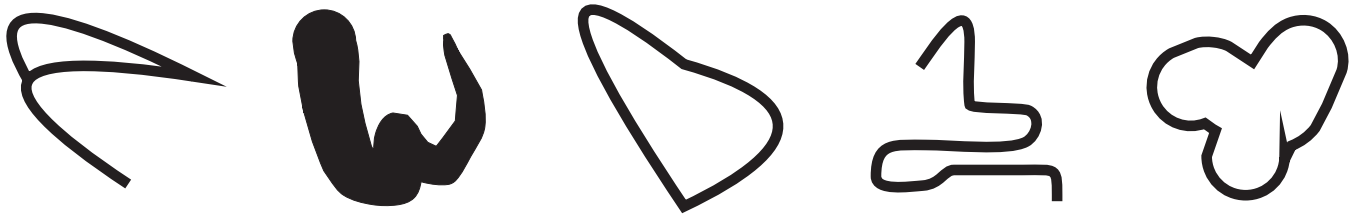

3

# **TABLE OF ANSWERS –** PLANTILLA DE RESPUESTAS

**The correct answers are shown below. If the correct answer is the first figure of the plate, the number 1 is shown; if the correct answer is the second figure, a number 2 will be shown, and so on.**

A continuación se muestra la plantilla de corrección, que contiene el número de cada una de las láminas y la respuesta correcta para cada una de ellas. Si la respuesta correcta es la primera figura de la lámina el número mostrado es un 1; si la respuesta correcta corresponde con la segunda figura aparece un 2, y así sucesivamente.

| ITEM # | CORRECT ANSWER |
|---|---|
| **1** | 1 |
| **2** | 2 |
| **3** | 2 |
| **4** | 1 |
| **5** | 2 |
| **6** | 3 |
| **7** | 1 |
| **8** | 3 |
| **9** | 2 |
| **10** | 4 |
| **11** | 1 |
| **12** | 2 |
| **13** | 2 |
| **14** | 1 |
| **15** | 2 |
| **16** | 1 |
| **17** | 1 |
| **18** | 2 |
| **19** | 2 |
| **20** | 1 |
| **21** | 3 |
| **22** | 2 |
| **23** | 3 |
| **24** | 4 |
| **25** | 4 |

| ITEM # | CORRECT ANSWER |
|---|---|
| **26** | 1 |
| **27** | 2 |
| **28** | 1 |
| **29** | 1 |
| **30** | 2 |
| **31** | 2 |
| **32** | 1 |
| **33** | 1 |
| **34** | 1 |
| **35** | 2 |
| **36** | 3 |
| **37** | 3 |
| **38** | 2 |
| **39** | 2 |
| **40** | 3 |
| **41** | 2 |
| **42** | 1 |
| **43** | 2 |
| **44** | 3 |
| **45** | 2 |
| **46** | 4 |
| **47** | 4 |
| **48** | 3 |
| **49** | 2 |
| **50** | 1 |

| ITEM # | CORRECT ANSWER |
|---|---|
| **51** | 4 |
| **52** | 3 |
| **53** | 1 |
| **54** | 2 |
| **55** | 1 |
| **56** | 1 |
| **57** | 1 |
| **58** | 2 |
| **59** | 1 |
| **60** | 2 |
| **61** | 2 |
| **62** | 2 |
| **63** | 3 |
| **64** | 3 |
| **65** | 2 |
| **66** | 3 |
| **67** | 2 |
| **68** | 2 |
| **69** | 4 |
| **70** | 1 |
| **71** | 2 |
| **72** | 2 |
| **73** | 4 |
| **74** | 1 |
| **75** | 2 |

| ITEM # | CORRECT ANSWER |
|---|---|
| **76** | 4 |
| **77** | 1 |
| **78** | 2 |
| **79** | 1 |
| **80** | 2 |
| **81** | 1 |
| **82** | 1 |
| **83** | 1 |
| **84** | 2 |
| **85** | 1 |
| **86** | 1 |
| **87** | 2 |
| **88** | 1 |
| **89** | 1 |
| **90** | 2 |
| **91** | 3 |
| **92** | 2 |
| **93** | 1 |
| **94** | 1 |
| **95** | 2 |
| **96** | 1 |
| **97** | 3 |
| **98** | 1 |
| **99** | 2 |
| **100** | 3 |