Transformations, Congruence & Similarity

Vocabulary:

1. *Reflection:* Flip or mirror image
2. *Rotation:* Turn
3. *Translation:* slide
4. *Dilation:* enlarge or reduce a shape by multiplying/dividing by a scale factor.
5. *Congruent:* shapes that are exactly the same—same shape and same size
6. *Similar:* shapes that have the same shape but different (proportional) size

Symbols:

≅ means **congruent**

~ means **similar**

$m\angle x$ means **"the measure of angle x"**

$\overline{XY}$ means **"line segment"** or **"side length"** from point X to point Y

∥ means **"is parallel to"**

MGSE8G.1 – Corresponding Parts after Transformations

Review Tips:

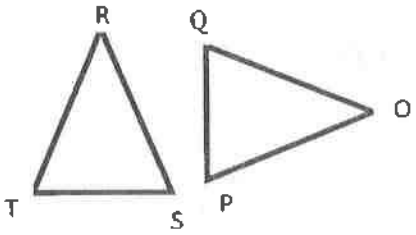
I. When finding corresponding (matching) parts of two shapes after going through a transformation, if you choose to visualize the transformation, only focus on one point at a time.

II. If the text gives you the names of the figures, one strategy is to "line up" the letter names to tell which parts will correspond.

Practice Problems:

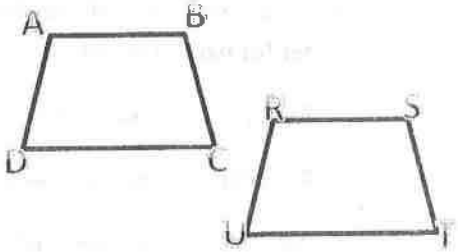
❶ Figure RST has been rotated 90° clockwise to form figure OPQ. Which of the following statements is true?

A. $m\angle R \cong m\angle Q$
B. $m\angle S \cong m\angle P$
C. $\overline{RS} \cong \overline{PQ}$
D. $\overline{ST} \cong \overline{OP}$



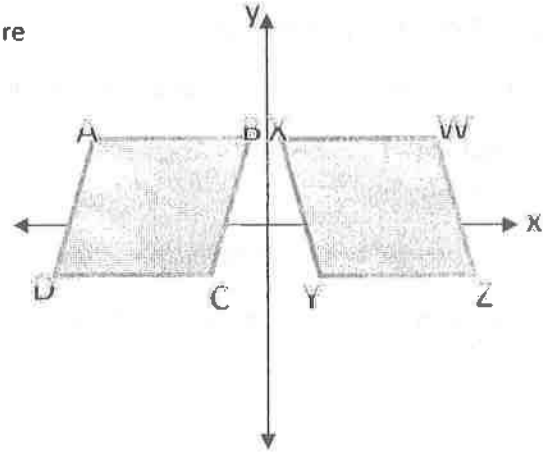
❷ Trapezoid ABCD has been translated down and to the right to form trapezoid RSTU. Given that $\overline{AB} \parallel \overline{DC}$, which of the following statements is true?

A. $\overline{AB} \cong \overline{DC}$
B. $\overline{ST} \cong \overline{UT}$
C. $\overline{AB} \parallel \overline{RS}$
D. $\overline{RS} \parallel \overline{UT}$



❸ Figure *ABCD* has been reflected across the *y*-axis to form figure *WXYZ*. Which of the following statements is true?

A. $m\angle A \cong m\angle Y$
B. $m\angle D \cong m\angle X$
C. $\overline{AB} \cong \overline{WX}$
D. $\overline{AB} \cong \overline{YZ}$



MGSE8.G.2 – Sequences of Transformations making Congruent Figures

Review Tips:

I. Remember that ROTATIONS, REFLECTIONS, and TRANSLATIONS *do not* change the size of a figure (they keep the figure **congruent** to the original).
II. When attempting to visualize a "sequence" of transformations where the middle step is not shown, only test one point of the figure at a time.
III. Always identify the original figure before deciding on an answer.

Practice Problems:

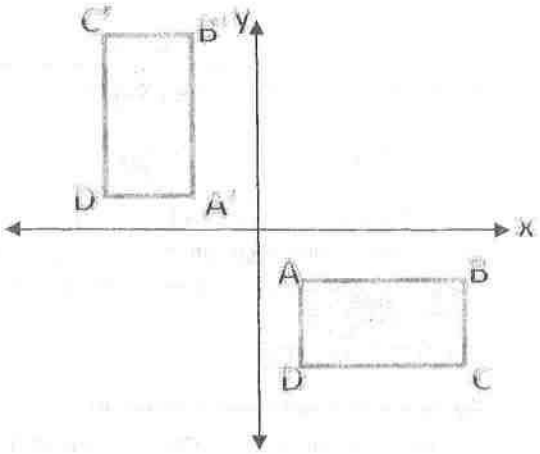
❶ Rectangle ABCD has been rotated 90° clockwise and reflected across the *x*-axis to form rectangle A'B'C'D'. What is true about the rectangles?

A. Rectangle ABCD is congruent to rectangle A'B'C'D'.

B. Rectangle ABCD is similar but not congruent to rectangle A'B'C'D'.

C. Rectangle ABCD has the same angle measures as A'B'C'D' but different side lengths.

D. Rectangle ABCD has no relationship with Rectangle A'B'C'D'.



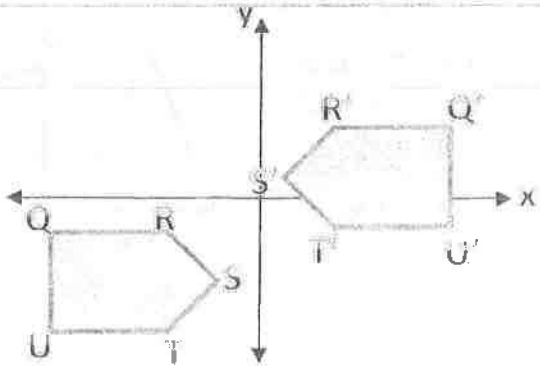
❷ Which sequence of transformations might have happened in order for figure QRSTU to form Q'R'S'T'U' as shown to the right?

A. Reflection across the *x*-axis, translation 3 units left.

B. Reflection across the x-axis, translation 3 units right.

C. Reflection across the y-axis, translation 4 units up.

D. Reflection across the y-axis, translation 4 units down.



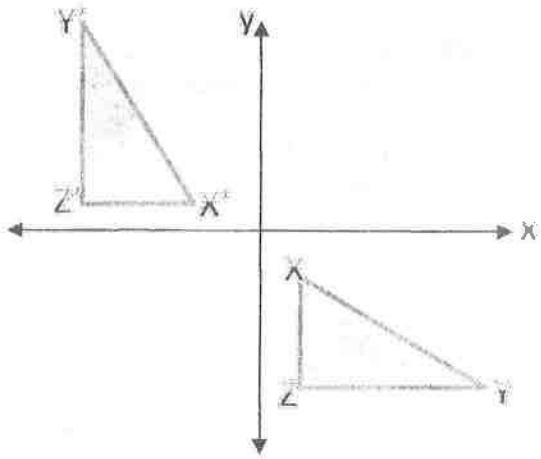
❸ Which sequence of transformations could triangle XYZ have gone through to produce figure X'Y'Z' as shown to the right?

A. Rotation 90° clockwise, translation 4 units up and 3 units right.

B. Rotation 90° counterclockwise, translation 3 units up and 4 units right.

C. Rotation 90° clockwise, reflection across the *y*-axis

D. Rotation 90° counterclockwise, reflection across the *y*-axis.



MGSE8G.3 – Transformations on a Coordinate Plane

Review Tips:

1. When dealing with specific coordinates (*x*, *y*), keep these rules in mind:

Reflection across the *x*-axis: Keep x-value the same, take the opposite of new *y*-value [*Example: (3, 2) → (3, -2)]*

Reflection across the *y*-axis: Keep y-value the same, take opposite of new *x*-value [*Example: (3, 2) → (-3, 2)*]

Rotation 90° clockwise: Switch coordinates, take opposite of new y-value [*Example: (3, 2) → (2, -3)*]

Rotation 90° counterclockwise: Switch coordinates, take opposite of new *x*-value [*Example: (3, 2) → (-2, 3)*]

Rotation 180°: Take opposite of both x-value and y-value [*Example: (3, 2) → (-3, -2)*]

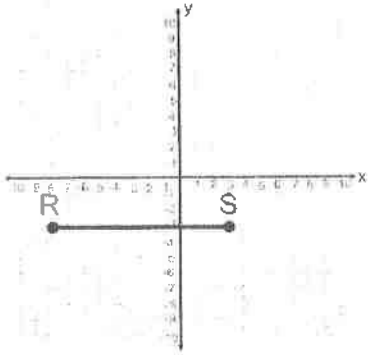
Translations: If given a rule, use the coordinates given and "plug" them in for the x and y in the second part of the rule [*Example:* Rule: (x, y) → (x – 10, y + 4), Coordinate given: (3, 2); (3 – 10, 2 + 4) = (-7, 6)]
-If given "directions", remember "left" and "right" affect the *x*-value. "Up" and "Down" affect the y-value.

Dilations: multiply both the x and y values by the scale factor (*k*) given. [*Example: k = 3, coordinate given (3, 2) → (9, 6) or k = ½, coordinate given (3, 2) → (1.5, 1)*]

Practice Problems:

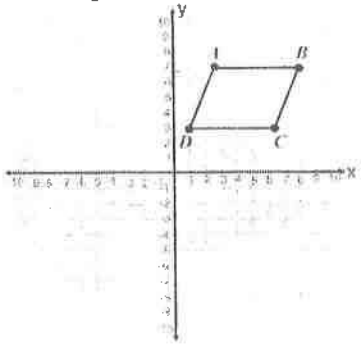
❶ Line segment *RS* is shown below with coordinates *R*(-8, -3) and *S*(3, -3). Which coordinate below would represent *R'* if point *R* was reflected across the *x*-axis?

A. (-8, 3)
B. (3, 3)
C. (8, -3)
D. (-3, -3)



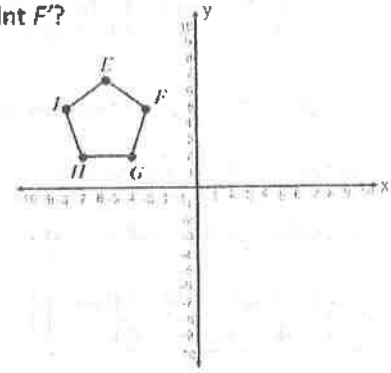
❷ If parallelogram *ABCD* is translated left two units and down 5 units, what is the resulting coordinate of *B'* ?

A. (10, 2)
B. (8, 2)
C. (6, 7)
D. (6, 2)



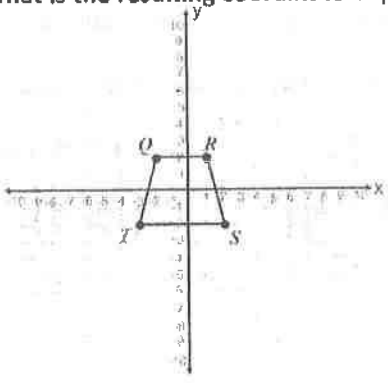
❸ If figure *EFGHI* is rotated 270° counter-clockwise about the origin, What would be the resulting coordinate of point *F'*?

A. (-3, -5)
B. (-5, -3)
C. (5, 3)
D. (5, -3)



❹ If trapezoid *QRST* is dilated about the origin by a scale factor *(k)* of 2, what is the resulting coordinate of point *T'*?

A. (6, 2)
B. (-5, -4)
C. (-6, -4)
D. (-1, -4)



MGSE8.G.4 – Sequences of Transformations making Similar Figures

Review Tips:

I. Remember that any time a DILATION is included in a sequence of transformations, it will change the size and produce a **similar** figure to the original *(angles* will be the same; *side lengths* will be proportional)
II. When attempting to visualize a "sequence" of transformations where the middle step is not shown, only test one point of the figure at a time.

Practice Problems:

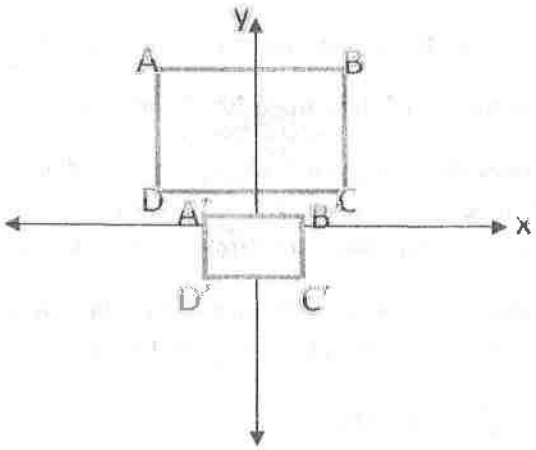
❶ Rectangle ABCD has been translated 5 units down and dilated by a scale factor (*k*) of ½ to form rectangle A'B'C'D'. What is true about the rectangles?

A. Rectangle ABCD is congruent to rectangle A'B'C'D'.

B. Rectangle ABCD is similar but not congruent to rectangle A'B'C'D'.

C. Rectangle ABCD has the same side lengths but different angle measures than rectangle A'B'C'D'.

D. Rectangle ABCD has no relationship with Rectangle A'B'C'D'.



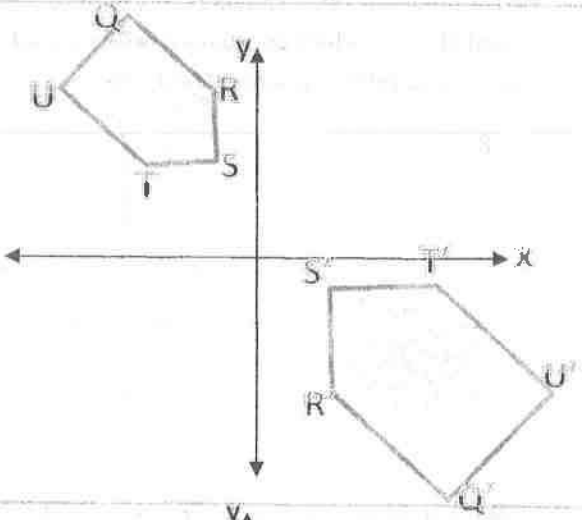
❷ Which sequence of transformations might have happened in order for figure QRSTU to form Q'R'S'T'U' as shown to the right?

A. Rotation 90° clockwise, dilation using $k = 3/2$

B. Rotation 180°, dilation using $k = 1/3$

C. Rotation 90° clockwise, dilation using $k = 1/3$

D. Rotation 180°, dilation using $k = 3/2$



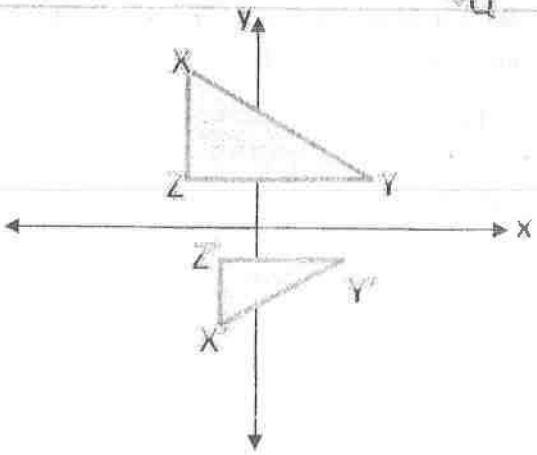
❸ Which sequence of transformations could triangle XYZ have gone through to produce figure X'Y'Z' as shown to the right?

A. Reflection across the y-axis, dilation using $k = 2$

B. Reflection across the *y*-axis, dilation using $k = ½$

C. Reflection across the *x*-axis, dilation using $k = 2$

D. Reflection across the *x*-axis, dilation using $k = ½$



MGSE8.G.5 – Similar Triangles, Exterior Angles, Parallel Lines

Review Tips:

I. All the interior (inside) angles of a triangle always add up to 180°

II. Angles that form a straight line always add up to 180°

III. The exterior (outside) angle of a triangle always adds up to the two opposite interior angles.

IV. When a transversal cuts through a set of parallel lines, all the acute angles are equal to each other and all the obtuse angles are equal to each other.

V. *Angle-Angle Criterion:* Two triangles are considered similar if they have at least 2 matching angles.

Practice Problems:

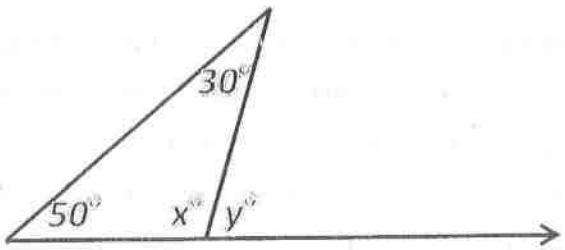
❶ Use the figure to the right to find the value of $x°$ and $y°$.

A. $x° = 120°, y° = 60°$

B. $x° = 80°, y° = 100°$

C. $x° = 60°, y° = 120°$

D. $x° = 100°, y° = 80°$



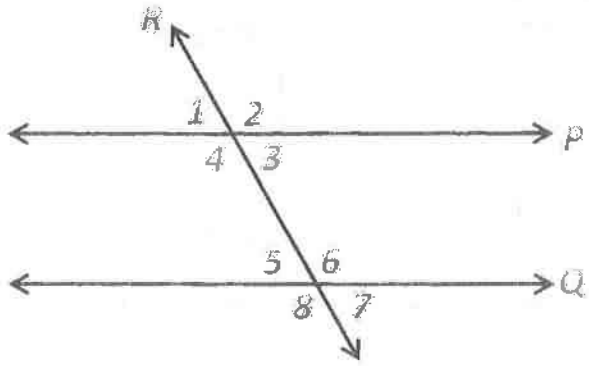
❷ Line $P \parallel$ Line Q and are cut by transversal R. Given that $m\angle 1 = 35°$, which statement below is true?

A. $m\angle 2 = 35°$

B. $m\angle 3 = 35°$

C. $m\angle 5 = 145°$

D. $m\angle 7 = 145°$



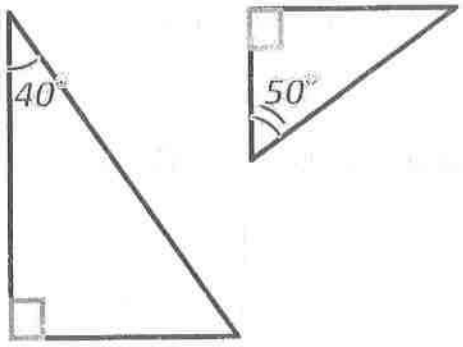
❸ Consider the triangles to the right. Which statement is true?

A. The triangles are congruent because of angle-angle criterion

B. The triangles are similar because of angle-angle criterion

C. The triangles are neither similar nor congruent because angle-angle criterion has not been met

D. There is not enough information to determine similarity or congruence.



Exponents & Square Roots

Vocabulary:

1. *Exponent:* part of a power that tells you how many times to use the base as a factor (multiplication)
2. *Negative exponent:* tells you that a power is less than one and should be written as a *fraction*
3. *Scientific Notation:* a way to write very large or very small numbers using powers of ten
4. *Linear:* forms a straight line
5. *Rational Number:* any number that can be written as a ratio (fraction)
6. *Irrational Number:* any number whose decimal form never repeats and never ends (most common: $\sqrt{2}$, π)

Symbols:

$\sqrt{\ }$ means **Find the square root** (which number multiplied by itself produces the number inside the box)

$\sqrt[3]{\ }$ means **Find the cubed root** (which number multiplied by itself 3 times would produce the number inside the box)

MGSE8.EE.1 – Properties of Exponents

Review Tips: Exponent Rules

Multiplying: Keep the base number, add the exponents *[Example: $a^2 \bullet a^5 = a^{2+5} = a^7$]*

Dividing: Keep the base number, subtract the exponents *[Example: $\frac{b^{10}}{b^4} = b^{10-4} = b^6$]*

Negative: move the power across the division bar and change the exponent from negative to positive *[Example: $x^{-4} = \frac{1}{x^4}$]*

Zero: any number (except zero) to the zero power = 1 *[Example: $4^0 = 1$, $200^0 = 1$, $(-9)^0 = 1$]*

Different Base Powers: the exponents of different bases **cannot** be combined. *[Example: $a^3b^4 = a^3b^4$]*

Practice Problems:

1 Evaluate: $4^2 \cdot 4^2$

A. 16^4
B. 256
C. 1
D. 65,536

2 Evaluate: $\frac{3^7}{3^5}$

A. 36
B. $\frac{1}{9}$
C. 9
D. 3^{12}

3 Evaluate: 4^{-3}

A. 64
B. -64
C. -12
D. $\frac{1}{64}$

4 Evaluate: 58^0

A. 1
B. 58
C. 0
D. -58

MGSE8.EE.2 – Perfect Squares & Perfect Cubes

Review Tip:

I. To "un-square" a number, you must take the square root. *[Example: $3^2 = 9$ therefore $\sqrt{9} = 3$]*

II. To "un-cube" a number, you must take the cube root *[Example: $5^3 = 125$ therefore $\sqrt[3]{125} = 5$]*

Practice Problems:

5 Evaluate: $\sqrt{100}$

A. 10
B. 50
C. 25
D. 98

6 Evaluate: $\sqrt[3]{64}$

A. 10
B. 8
C. 21.3
D. 4

7 Find the value of x:

$$x^2 = 16$$

A. ± 4
B. ± 8
C. 4
D. 8

8 Find the value of x:

$$x^3 = -8$$

A. ± 4
B. ± 2
C. -2
D. -4

Scientific Notation

MGSE8.EE.3 – Writing in Scientific Notation
MGSE8.EE.4 – Operations in Scientific Notation

Review Tips:

I. Numbers written in scientific notation must have only one number (1 – 9) in front of the decimal place.
[Correct Example: 3.45×10^6 Incorrect Example: 34.5×10^6]
II. Numbers with **positive exponents** are very large numbers (greater than 1) *[Example: $3.45 \times 10^6 = 3{,}450{,}000$]*
III. Numbers with **negative exponents** are very small numbers (less than 1) *[Example: $3.45 \times 10^{-6} = 0.00000345$]*
IV. To *multiply or divide* numbers expressed in scientific notation, combine the coefficients first and the powers of ten second. Put in proper format if necessary.
[Example: $(2.1 \times 10^4) \times (9 \times 10^5) = (2.1 \times 9) \times (10^4 \times 10^5) = 18.9 \times 10^9 = 1.89 \times 10^{10}$]
V. To *add or subtract* numbers in scientific notation, re-write the numbers in standard form, combine, and put back in scientific notation. *[Example: $(2.1 \times 10^4) + (9 \times 10^5) = 21{,}000 + 900{,}000 = 921{,}000 = 9.21 \times 10^5$]*
VI. *Adjusting an answer* to "perfect" scientific notation:
  i. Too big? Move the decimal and **ADD** to the exponent. *[Example: $23.8 \times 10^4 = 2.38 \times 10^5$]*
  ii. Too small? Move the decimal and **SUBTRACT** from the exponent. *[Example $0.238 \times 10^9 = 2.38 \times 10^8$]*
VI. Standard calculators will represent a power of ten by using and "E".
[Example: 3.45×10^8 on a calculator would read 3.45 E 8]

Practice Problems:

1. What is 6.79×105 written in standard form?
   A. 67,900,000 B. 679,000 C. 0.00000679 D. 0.0000679

2. The width of a human hair is approximately 0.0002 in. What is this width written in scientific notation?
   A. 2×10^3 in. B. 2×10^{-3} in. C. 2×10^4 in. D. 2×10^{-4} in.

3. Evaluate: $(6.7 \times 104) \times (9.1 \times 106)$
   A. 6.097×10^{11} B. 6.097×10^{10} C. 6.097×10^9 D. 60.97×10^{10}

4. How many times larger is (5.4×106) than (9×103)?
   A. 0.6×10^3 B. 6×10^3 C. 6×10^2 D. 6×10^4

5. Subtract: $(3.4 \times 105) - (2.1 \times 104)$
   A. 3.19×10^3 B. 3.19×10^5 C. 1.3×10^1 D. 1.3×10^5

6. Add: $12{,}000 + (3.4 \times 105)$
   A. 4.6×10^5 B. 4.6×10^9 C. 3.52×10^5 D. 3.52×10^3

7. Which value would be the most likely measurement of the distance from the earth to the moon?
   A. 1.3×10^9 ft. B. 1.3×10^{100} ft. C. 1.3×10^{-9} ft. D. 1.3×10^2 ft.

8. The display on a calculator reads 9.378 E -5. Which value does this represent?
   A. 937,800,000 B. 937,800 C. 0.00009378 D. 0.000009378

Solving Equations

MGSE8.EE.7.a – Multi-Step Equations
MGSE8.EE.7.b – Equations with One, None, or Infinite Solutions

Review Tips:

I. Equations with:
- i. *One solution*: Different on both sides *[Example: **x = 5** or **2x + 6 = 3x – 4**]*
- ii. *Infinite Solution*: Same on both sides *[Example: **5 = 5** or **2x + 6 = 2x + 6**]*
- iii. *No solution*: Same variable term, different constant *[Example: **5 = 6** or **3x + 5 = 3x – 2**]*

II. *Distributive Property*: multiply all numbers in the group by the coefficient. *[Example: 4(x – 5) → 4x – 20]*
III. *Combining Like Terms*: only terms with the same variable can be added or subtracted. *[Example: 4x + 3 – 2x → 2x + 3]*

Practice Problems:

❶ Which of the following equations will have **no solution** when simplified?

A. $3x - 4 = 5x + 2$ B. $8x + 5 = 8x$ C. $5x = 5x$ D. $4x = 32$

❷ Find the value of *x*: $4x + 2(x - 3) = 6x - 6$

A. $x = 0$ B. $x = 6$ C. Infinite solutions D. No solution

❸ Simplify the expression: $\frac{1}{2}(4x + 6) = -5x + 24.7$

A. $x = 3.1$ B. $x = 3$ C. $x = 7$ D. $x = -7.23$

❹ A student worked the following equation, showing his steps. In which step did he make a mistake?

A. Step 1
B. Step 2
C. Step 3
D. He made no error.

$$5(x - 3) - 2x = 5x - 11$$
[Step 1]→ $5x - 15 - 2x = 5x - 11$
[Step 2]→ $3x - 15 = 5x - 11$
[Step 3] → $-2x = 4$
[Step 4] → $x = -2$

❺ Find the value of *x*: $\frac{x}{2} + 5 = 12$

A. $x = 14$ B. $x = 7$ C. $x = 34$ D. No solution

❻ Solve the equation for *x*: $\frac{3}{4} + \frac{1}{2}x = x - \frac{1}{4}$

A. $x = \frac{1}{2}$ B. $x = 5$ C. $x = 1$ D. $x = 2$

❼ Solve the equation for *x*: $-10(x + 2) - 5x = -9x + 16$

A. $x = -6$ B. $x = 6$ C. $x = \frac{1}{6}$ D. $x = \frac{3}{2}$

Rational & Irrational Numbers

MGSE8.NS.1 – Rational & Irrational Numbers; Converting Repeating Decimals to Fractions
MGSE8.NS.2 – Estimating Irrational Numbers & Locating on a Number Line

Review Tips:

I. *Rational Numbers*: whole numbers, negatives, decimals (that end or repeat), perfect square roots, fractions.
[Examples: 3, 8.9, ½, -6.709, $0.\overline{3}$, $\sqrt{25}$]
II. *Irrational Numbers*: numbers whose decimal form never repeats and never ends *[Examples: π, $\sqrt{2}$, 8.97425...]*
III. *Repeating decimals → Fractions*: set up a system of equations that allows you to eliminate the repeating portion; solve the system. *Example:* $0.\overline{3}$ =

$$\begin{aligned} 10x &= 3.333\ldots \\ -\quad x &= 0.333\ldots \\ \hline 9x &= 3 \end{aligned}$$

$$x = \frac{3}{9} \rightarrow \frac{1}{3}$$

Practice Problems:

❶ Which of the following numbers is **irrational?**

A. 45.8 B. $\sqrt{50}$

C. $\sqrt{100}$ D. $0.\overline{16}$

❷ Which of the following numbers is **rational?**

A. π B. $\sqrt{2}$

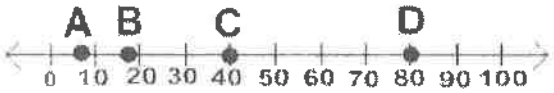
C. 4.567... D. 23

❸ What is $0.\overline{5}$ in fraction form?

A. $\frac{1}{2}$ B. $\frac{1}{5}$

C. $\frac{5}{9}$ D. $\frac{5}{10}$

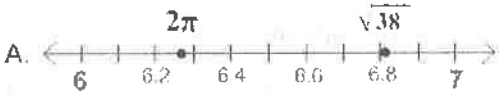
❹ Which point shows the approximate value of $\sqrt{40}$ on the number line below?

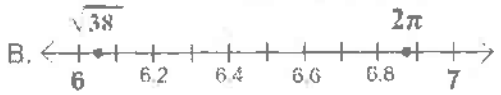


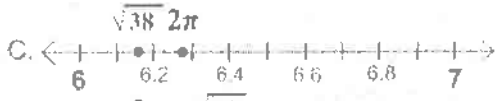
A. Point A B. Point B

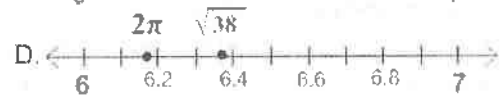
C. Point C D. Point D

❺ Which number line best represents the locations of 2π and $\sqrt{38}$?

A. 

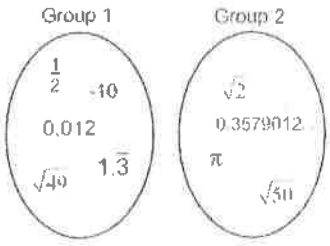
B. 

C. 

D. 

❻ Haley was attempting to classify the two groups of numbers shown below. Which titles would be most appropriate for the groups?

A. 1: Rational Numbers
2: Irrational Numbers
B. 1: Rational Numbers
2: Real Numbers
C. 1: Real Numbers
2: Imaginary Numbers
D. 1: Whole Numbers
2: Square Roots



Pythagorean Theorem

MGSE8.G.6 – Pythagorean Theorem Proof
MGSE8.G.7 – Pythagorean Theorem in Various Contexts
MGSE8.G.8 – Pythagorean Theorem & Distance between Two Points

Vocabulary:

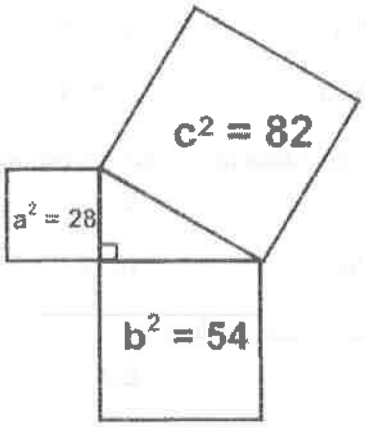
1. *Hypotenuse:* The longest side of a right triangle, directly across from the right angle
2. *Pythagorean Theorem:* Uses $a^2 + b^2 = c^2$ on the side lengths of right triangles.

Review Tips:

I. In a right triangle, the squares of the smaller sides always add to equal the square of the largest side.
II. The hypotenuse is always "c" in the equation $a^2 + b^2 = c^2$
III. When finding the distance between two points on a coordinate plane, draw a line from point to point, and then draw a right triangle based on the line you used to connect the points.

Practice Problems:

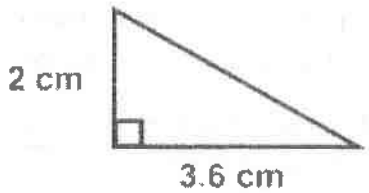
❶ Does the figure to the right form a right triangle? Why or why not?



A. Yes; A right triangle is formed because the length of the smaller sides add up to the largest side.
B. Yes; A right triangle is formed because the squares of the smaller sides add up to the square of the largest side.
C. No; A right triangle was not formed because the length of the smaller sides does not add up to the largest side.
D. No; a right triangle was not formed because squares of the smaller sides do not add to equal the square of the largest side.

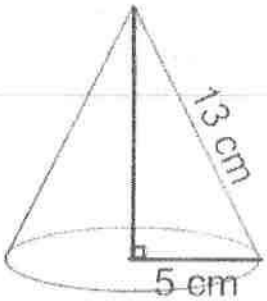
❷ Find the length of the missing side of the right triangle.

A. $\sqrt{12.96}$
B. $\sqrt{5.6}$
C. $\sqrt{16.96}$
D. $\sqrt{7.2}$

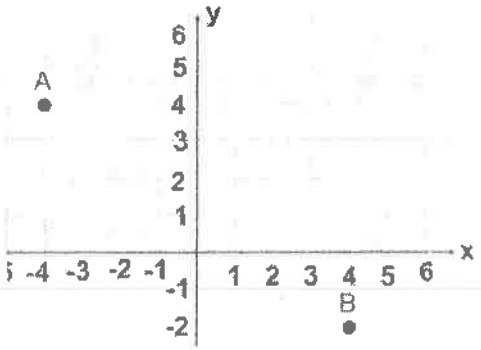


❸ What is the height of the cone if the slant height is 13 cm?

A. 8 cm
B. 18 cm
C. 144 cm
D. 12 cm



❹ Find the distance between point A and point B as shown on the coordinate plane below.



A. 10 units
B. 14 units
C. 100 units
D. 9 units

Volume

MGSE8.G.9 – Applying Volume Formulas to Cylinders, Cones, & Spheres

Vocabulary:

1. *volume*: how much something holds/how much space is *inside* a 3D object

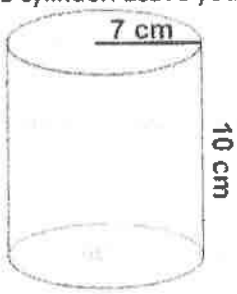
Formulas:

Cylinder: $V = \pi r^2 h$ Cone: $V = \frac{1}{3}\pi r^2 h$ Sphere: $V = \frac{4}{3}\pi r^3$

V = Volume, h = height, r = radius (halfway across a circle)

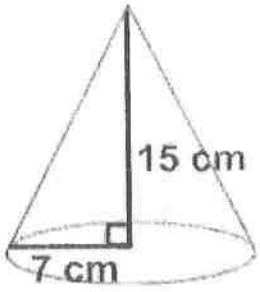
Practice Problems:

❶ Find the volume of the cylinder. Leave your answer in terms of π.



A. 70π cm^3
B. 17π cm^3
C. 1320π cm^3
D. 490π cm^3

❷ Find the volume of the cone. Use 3.14 for π.



A. 858.3 cm^3
B. 769.3 cm^3
C. 329.7 cm^3
D. 245 cm^3

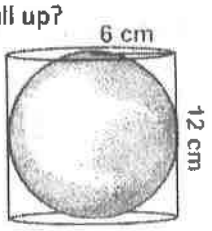
❸ If the basketball shown below has a radius of 6 inches from the center to the outside surface, *approximately* how many cubic inches of air will it hold when fully inflated?

A. 904.32 in^3
B. 288 in^3
C. 1808.64 in^3
D. 72 in^3

❹ Chris is planning to fill up a kiddie swimming pool for his younger sister but he does not have a water hose. He has decided to use a cylindrical bucket with a diameter of 12 inches and a height of 14.5 inches. He has already calculated the approximate volume of the kiddie pool to be able to hold about 60,000 cubic inches of water. Approximately how many buckets of water will he need to use in order to fill the kiddie pool?

A. Approximately 9 buckets
B. Approximately 115 Buckets
C. Approximately 37 buckets
D. Approximately 29 buckets

❺ A sphere has been placed inside a cylinder with the same dimensions; both have a radius of 6 cm, and a height of 12 cm. How many cubic centimeters of space does the sphere NOT fill up?



A. $432\pi\ cm^3$
B. $72\pi\ cm^3$
C. $288\pi\ cm^3$
D. $144\pi\ cm^3$

Functions

MGSE8.F.1 – Relations & Functions
MGSE8.F.2 – Comparing Functions in Various Contexts
MGSE8. F.3 – y = mx + b; Linear & Nonlinear
MGSE8.F.4 – Constructing Functions from Various Contexts; Interpreting Rate of Change & Initial Value in Various Contexts
MGSE8.F.5 – Describing Relationships between Two Quantities

Vocabulary:

1. *Function* – a relation where every input has exactly one output
2. *Rate of Change* – **(slope)** compares the change in y-values over the change in x-values (rise/run)
3. *Initial Value* – **(y-intercept)** the point where a graph touches the y-axis; the beginning value of a situation
4. *Linear Function* – A function that forms a straight line when graphed; has a constant slope

Is it a Function or Not? Review Tips:

I. When testing to see if a *graph* is a function, use the "Vertical Line Test". IF a vertical line would touch more than one point at least one time on a graph, it is NOT a function.
II. When looking at a table or coordinates, check for repeating inputs only. If repeating inputs have different outputs, it is NOT a function.

Practice Problems:

❶ Describe the relationship shown in the table of values.

A. Relation only
B. Function only
C. Relation and function
D. Neither relation nor function

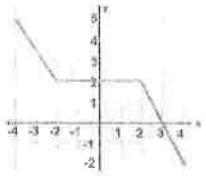
x	5	4	0
y	8	9	13

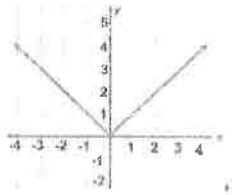
❷ Which of the following sets of ordered pairs represents a function?

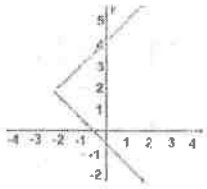
A. (2, 3), (6, 9), (10, 12), (2, -3)
B. (-9, 4), (-2, 10), (-2, 12), (0, 6)
C. (1, 2), (4, 9), (10, 22), (15, 7)
D. (0, 1), (0, 2), (0, 3), (0, 4)

❸ Which graph DOES NOT represent a function?

A. 

B. 

C. 

D. 

❹ Which of the following relations does NOT represent a function?

A. {(5, 8), (10, 2), (12, -2), (15, -5)}

B. $y = \frac{1}{2}x + 8$

C. Multiplying each input by 10 to produce an output

D.

Age	*13*	*14*	*12*	*13*
Eye Color	Brown	Blue	Green	Hazel

❺ Choose the best description of the relation shown below:

$$\{(2, 10), (4, 15), (6, 20), (8, 25)\}$$

A. The relation is a function because every input has exactly one output
B. The relation is a function because every output has exactly one input
C. The relation is not a function because every input is different.
D. It is impossible to tell if the relation is a function without knowing more coordinates.

Linear or Nonlinear? Review Tips:

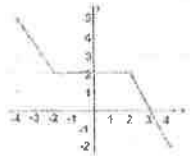
I. *Graphs*: straight line = linear. Any breaks or curves make it nonlinear.
II. *Tables*: check the slope (rise/run). Constant slope = Linear.
III. *Equations*: check the variables for exponents. Variables without exponents = linear. Variables with exponents (other than 1) = nonlinear. Also, variable in the denominator = nonlinear.

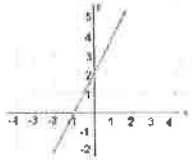
Practice Problems:

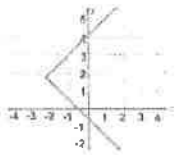
❶ Which equation shown below shows a *linear* relationship?

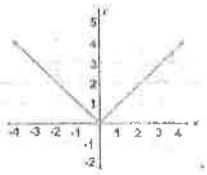
A. $y = 3x + 4$
B. $y = \frac{1}{2}x^2 - 1$
C. $2x^2 + y = 5$
D. $y = \frac{2}{x}$

❷ Which graph shows a *linear* relationship?

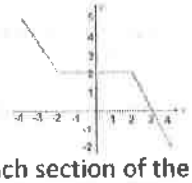
A. 

B. 

C. 

D. 

❸ Choose the best description of the graph shown below:



A. Linear because each section of the graph is a different straight line segment.
B. Nonlinear because each segment has a different slope.
C. Both linear and nonlinear because it is made up of straight line segments but is not a complete straight line.
D. Neither linear nor nonlinear because it is made up of straight line segments but is not a complete straight line.

❹ Which table shows *nonlinear* relationship?

A.

x	5	4	0
y	8	9	13

B.

x	-1	0	1
y	15	18	21

C.

x	5	7	9
y	15	11	5

D.

x	5	7	9
y	15	11	7

$y = mx + b$ Review Tips:

I. m = slope (rise/run) II. b = y-intercept (where $x = 0$)

Practice Problems:

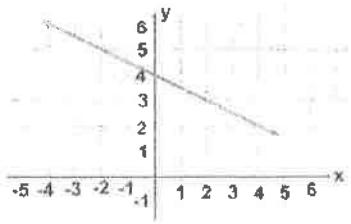
❶ Which equation represents the table?

x	-1	0	1
y	15	18	21

A. $y = 18x + 3$ B. $y = 3x + 18$
C. $y = -3x + 18$ D. $y = \frac{1}{3}x + 18$

❷ Which equation represents the graph?

A. $y = 4x - 2$
B. $y = \frac{1}{2}x + 4$
C. $y = -2x + 4$
D. $y = -\frac{1}{2}x + 4$



❸ Which equation represents a line passing through the points (2, 5) and (4, 10)?

A. $y = \frac{5}{2}x$ B. $y = \frac{2}{5}x$
C. $y = 5x + 2$ D. $y = 2x + 5$

❹ David's allowance is $5 every week, plus $2 for each extra chore he does. Which equation shows his total allowance (A) every week, depending on the number of extra chores (c) he completes?

A. $A = 5c + 2$ B. $A = 2c + 5$
C. $A = 7c$ D. $A = 2 + 5$

Comparing Two Different Functions Review Tips:

1. **Only focus on one component at a time;** *[For example, only find the y-intercept of each situation first. Then move on to the slope.]*

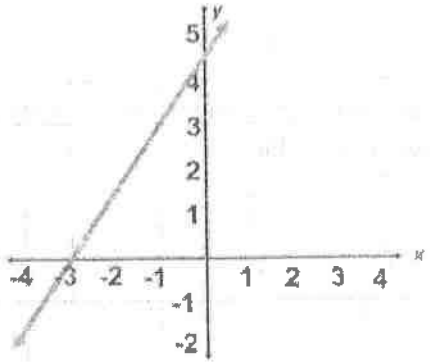
Practice Problems:

❶ **Compare the equation in Item 1 with the graph in Item 2.**

Item 1

$y = -3x + 4.5$

Item 2



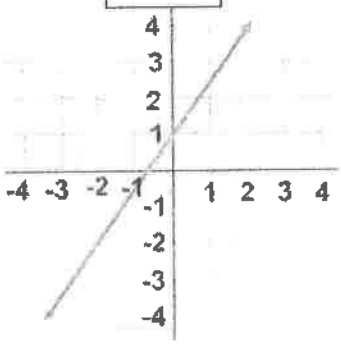
A. Items 1 and 2 have the same rate of change, and the same y-intercepts.
B. Items 1 and 2 have the same rate of change, but different y-intercepts.
C. Items 1 and 2 have different rates of change, but the same y-intercepts.
D. Items 1 and 2 have the different rates of change, and different y-intercepts.

❷ **Consider the table of values and the graph to the right. Choose the statement below that best compares the two.**

Table

x	y
4	2
8	5
12	8

Graph



A. The table has an increasing rate of change while the graph has a decreasing rate of change; the graph and the table have the same y-intercepts.
B. Both the table and graph have increasing rates of change; The y-intercept of the graph is greater than that of the table.
C. Both the table and graph have decreasing rates of change; The y-intercept of the table is greater than that of the graph.
D. The table has a decreasing rate of change while the graph has an increasing rate of change; The y-intercept of the graph is greater than that of the table.

❸ **Consider the table of values and the equation to the right. Choose the statement that best compares the two.**

Table

x	y
4	2
8	5
12	8

Equation:

$y = -3x - 1$

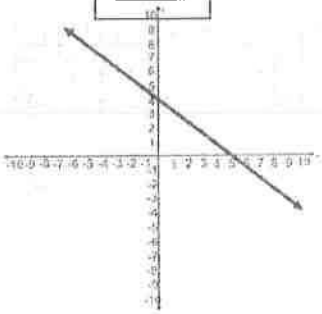
A. The table and equation have the same slope and the same y-intercepts.
B. The table and the equation have the same slope, but different y-intercepts.
C. The table and the equation have different slopes and different y-intercepts.
D. The table and the equation have different slopes, but the same y-intercept.

❹ **Compare the equation and the graph. Choose the statement below that best describes the functions:**

Equation:

$2y = 4x + 6$

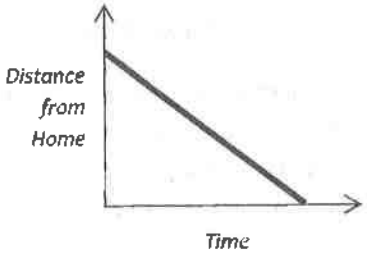
Graph



A. The difference between the y-intercepts is 2.
B. The difference between the y-intercepts is 1.
C. The y-intercepts are equal
D. The rates of change are equal

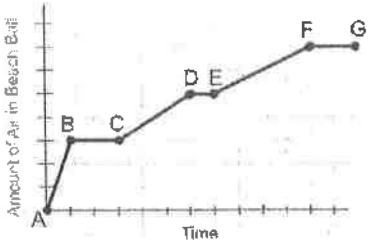
Describing the Relationship between Two Quantities:

❶ **The graph below show's Maggie's distance from home. Which scenario could be a possible explanation for the path shown by the graph?**



A. Maggie starts at home and walks down a hill to her friend's house.
B. Maggie starts at her friend's house and walks straight home.
C. Maggie starts at home and walks south-east.
D. Maggie starts at her friend's house, passes her home and goes to the store.

Use the graph below to answer questions ❷ & ❸.



❷ **Isaac is attempting to inflate a large beach ball. The graph below shows the amount of air in the beach ball over a period of time. Between which points does it show that Isaac had to take a break from inflating the beach ball?**

A. $\overline{AB}, \overline{CD}, \& \overline{EF}$
B. $\overline{BC}, \overline{DE}, \& \overline{FG}$
C. $\overline{FG}$ only
D. $\overline{EG}$ only

❸ **Between which points was he inflating the beach ball the *fastest*?**

A. $\overline{AB}$
B. $\overline{BC}$
C. $\overline{CD}$
D. $\overline{EF}$

Word Problems - Interpreting Rate of Change and Initial Value Review Tips:

I. "*Interpret the Rate of Change*" – means interpret the slope. In a word problem, the slope/rate of change will be the value that happens multiple times (and in an equation, it will be the number being *multiplied* by the variable).
II. "*Interpret the Initial Value*" – means interpret the y-intercept. In a word problem, the y-intercept/initial value will be the beginning value of the situation. This value will only be counted one time in the situation (and in the equation, it will be the number without a variable).

Practice Problems:

❶ **Jordan is training to run a marathon. He can already run seven miles without stopping. Each week he is hoping to increase the amount he can run by at least ½ a mile. An equation of the situation is shown below.**
Interpret the y-intercept.

$$y = 7 + 0.5x$$

A. The y-intercept represents the total number of miles Jordan wants to be able to run.
B. The y-intercept represents the number of miles Jordan wants to add to his run each week.
C. The y-intercept represents the number of miles Jordan can run at the beginning of his training.
D. The y-intercept represents the total weeks he will have to train to reach his goal.

❷ A study was done to investigate the relationship between a between eating sugary snacks and a test that measures a student's memory and attention. The correlating linear model is shown below, where x represents the number of sugary snacks a student ate, and y represents the student's test score.

Interpret the rate of change (slope).

$$y = -5x$$

A. Eating zero sugary snacks is associated with a loss of five points on the test.
B. Each additional sugary snack eaten is associated with a loss of five points on the test.
C. An additional five sugary snacks is associated with a loss of five points on the test.
D. Not enough information is provided to interpret the slope.

❸ The graph below shows the cost of a particular taxi cab service in Chicago. Interpret the initial value and the rate of change for the graph.

A. The taxi charges $2 to enter the cab and an additional $2 for every mile traveled.
B. The taxi charges $4 to enter the cab and an additional $1 for every mile traveled.
C. The taxi charges $4 to enter the cab and an additional $2 for every mile traveled.
D. The taxi charges $0 to enter the cab and an additional $2 for every mile traveled.

❹ Luis worked at the town pet store and was in charge of draining and cleaning the fish tanks. He decided to record the amount of water in the tank and the time it took to drain the tank. Luis' data is shown in the table below. Interpret the initial value and the rate of change.

Water in Tank	60	50	40	30	10	0
Minutes spent Draining	0	1	2	3	4	5

A. The tank started with 60 gallons and drained at a rate of 5 gallons per minute.
B. The tank started with 60 gallons and drained in 10 minutes.
C. The tank started with 50 gallons and drained at a rate of 10 gallons per minute.
D. The tank started with 60 gallons and drained at a rate of 10 gallons per minute.

❺ Julie planted sunflowers in her garden. She was curious about how fast they grow so she kept a weekly log of their height. Once the sunflowers were full grown, Julie analyzed her data and calculated the equation below to represent the (H) height, In centimeters, of her sunflowers, depending how many (W) weeks had passed after planting.

Interpret the y-intercept.

$$H = 24w + 5$$

A. The y-intercept in this situation means that each sunflower was 5 cm tall when planted.
B. The y-intercept in this situation means that each sunflower was 24 cm tall when they were fully grown.
C. The y-intercept in this situation means that each sunflower grew 24 cm each week.
D. The y-intercept in this situation means that each sunflower grew 29 cm each week.

MGSE8.EE.5 – Graphing & Comparing Proportional Relationships
MGSE8.EE.6 – Similar Triangles & Slope; $y = mx$ vs. $y = mx + b$

Proportional Relationships Review Tips:

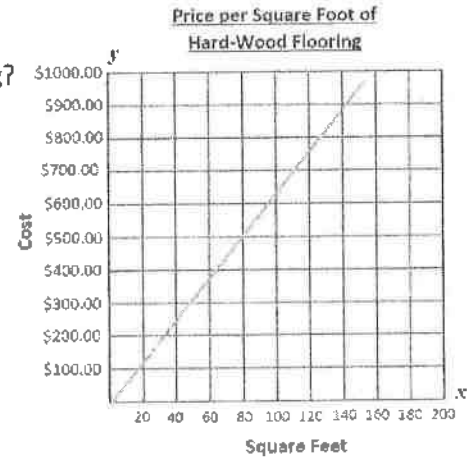
I. A relationship is proportional if it starts at **the origin (0, 0)** and continues in a **straight line (at a constant slope)**.
II. If the relationship is proportional, the rate of change can be found by finding rise/run OR by dividing the y-value by the x-value.
III. *Equations:* equations are proportional if they do not show a y-intercept *[Example: $y = 3x$ or $y = 0.2x$]*
IV. *Tables:* Tables show a proportional relationship when every y-value can divide by the x-value and get the same number.
V. *Graphs:* graphs show a proportional relationship if it starts at (0, 0) and continues in a straight line.
VI. **Unit Rate**: "how many in just 1"; you will use division to find unit rate. In a proportional relationship, the unit rate is the slope.

Practice Problems:

❶ James is remodeling his home and wants to put in all hard-wood flooring. The graph below shows the price of hard-wood flooring per square foot.

What is the unit rate per square foot of hard-wood flooring?

A. $500 per square foot of flooring
B. $6.25 per square foot of flooring
C. $100 per square foot of flooring
D. $5 per square foot of flooring

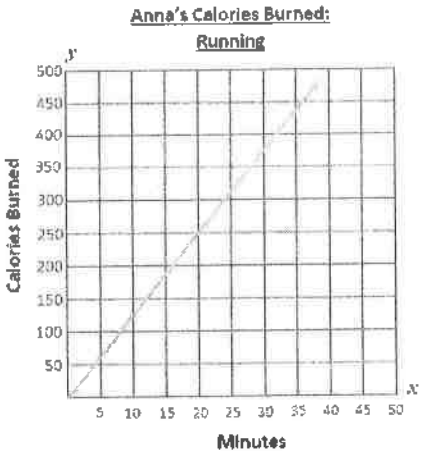


❷ Mike and Anna are having a weight loss competition. Mike wants to practice kickboxing to burn calories while Anna prefers to run. Mike records his calories burned in the table below and Anna graphs her calories burned in the graph.

Who burns more calories per hour?

A. Mike and Anna burn the same amount of calories per minute
B. Mike burns more calories per minute thank Anna.
C. Anna burns more calories per minute than Mike.
D. There is not enough information to determine who burns more calories per minute.

Mike's Calories Burned: Kickboxing	
Minutes	Calories
0	0
12	150
24	300
36	450



❸ Payton and Elizabeth are working on their keyboarding skills. Payton uses the equation below to show how many words *(W)* she can type per minute (*m*). The graph below represents how many words per minute Elizabeth can type.

Which statement below is most accurate?

A. Payton types at a faster rate.
B. Elizabeth types at a faster rate.
C. Payton and Elizabeth type at the same rate.
D. There is not enough information to compare the typing rates of Payton and Elizabeth.

Payton's Words per Minute

$W = 37m$

❹ Kinnady is applying to work at two different restaurants to earn money while she attends college. Both restaurants offer an hourly rate of pay as well as any tips she earns during her shift. The first restaurant gave their pay scale information in a table, while the second restaurant gave their information in a graph. Both are shown below.

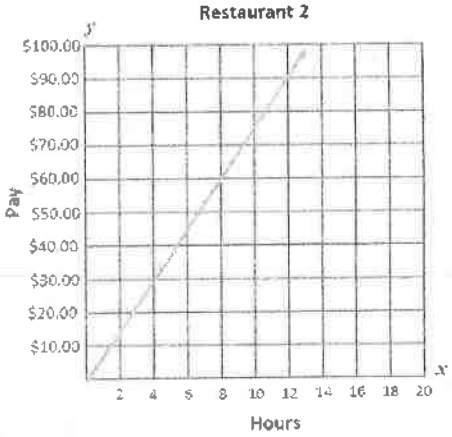
Which restaurant will pay Kinnady more money per hour?

A. Restaurant 1 will pay more per hour.
B. Restaurant 2 will pay more per hour.
C. Both restaurants will pay the same amount per hour.
D. There is not enough information provided to compare pay rates.

Restaurant 1

Hours	Pay
0	0
5	$36.25
10	$72.50
15	$108.75
20	$145.00

Restaurant 2



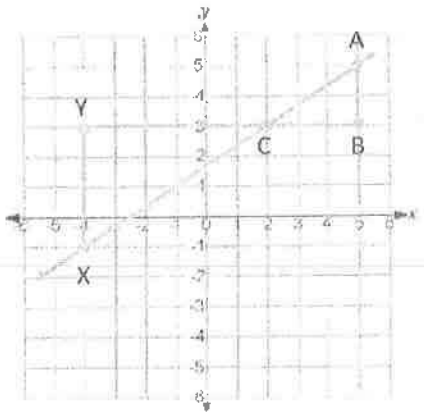
❺ Triangle ABC is similar to triangle XYC, and the hypotenuses of the triangles both lie on line $\overleftrightarrow{AX}$.

The slope between point C and point A is $\frac{2}{3}$.

What is the slope between point X and point C?

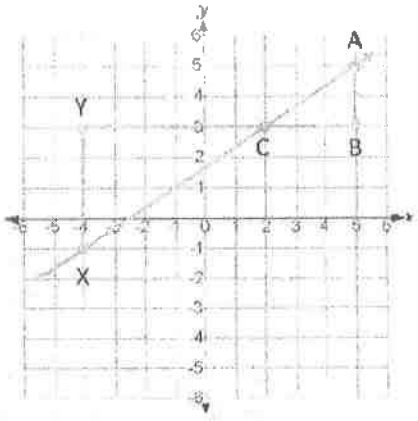
A. $-\frac{2}{3}$ B. $-\frac{3}{2}$

C. $\frac{2}{3}$ D. $\frac{3}{2}$



6 Triangle ABC is similar to triangle XYC, and the hypotenuses of the triangles both lie on line $\overleftrightarrow{AX}$.

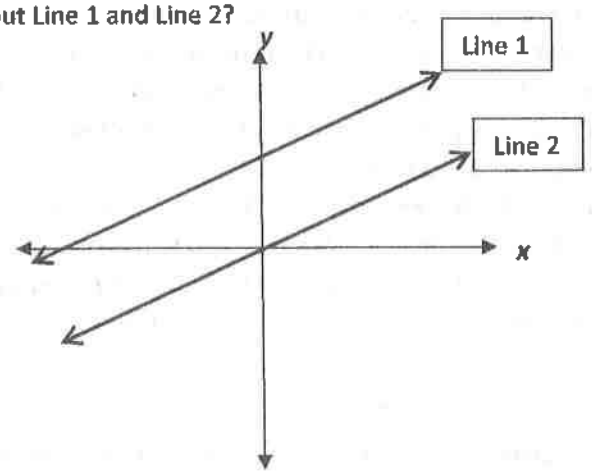
Which proportional statement below is TRUE?



A. $\frac{\overline{AB}}{\overline{BC}} = \frac{\overline{YC}}{\overline{XY}}$ B. $\frac{\overline{AB}}{\overline{BC}} = \frac{\overline{XY}}{\overline{XC}}$

C. $\frac{\overline{AB}}{\overline{AC}} = \frac{\overline{XY}}{\overline{XC}}$ D. $\frac{\overline{AC}}{\overline{BC}} = \frac{\overline{YC}}{\overline{XC}}$

7 Consider the graph below. Which statement is true about Line 1 and Line 2?



A. Line 1: $y = mx + b$
Line 2: $y = mx$

B. Line 1: $y = mx$
Line 2: $y = mx + b$

C. Line 1: $y = mx + b$
Line 2: $y = mx - b$

D. Line 1: $y = mx$
Line 2: $y = mx - b$

8 Given the equation $y = \frac{2}{3}x + 4$, which statement below is FALSE?

A. The line of the equation will have a positive slope, going up from left to right.
B. The y-intercept of the line will be (0, 4).
C. The line of the equation will have a negative slope, going down from left to right.
D. The graph will be a line with a constant slope which rises 2 units for every 3 units across.

9 Given the equation $y = -4x$, which statement below is TRUE?

A. The line of the equation will go down and through the origin.
B. The line of the equation will go up and through the origin.
C. The line of the equation will go down and through the point (0, -4)
D. The line of the equation will go up and through the point (0, -4)

Systems of Equations

MGSE8.EE.8.a-c – Analyze and solve systems of simultaneous linear equations.

Systems Review Tips:

I. A *solution* to a system means "the point (x,y) where the two lines intersect on a graph" or the (x,y) pair that the two equations would share.

II. *Graphing* – systems set up for graphing will both start with "y = " *[Example:* $y = 2x - 7$ *and* $y = -3x$*]*

III. *Substitution:* systems set up for substitution will have one equation starting with "y=" or "x=" and one in standard form *[Example:* $4x - y = 9$ *and* $y = -3x + 1$*]*

- When solving using *substitution*, "plug in" what y equals to the other equation *[Example:* $4x - (-3x + 1) = 9$*]*
- Solve the equation for x. When finished, plug your solution back into either equation for x, to solve for y.
- Your final answer will be two numbers in coordinate pair format: (*x*, *y*).

IV. *Elimination:* systems set up for elimination will have both equations in standard form.

[Example: $3x - 2x = 9$ *and* $7x + 2x = 10$*]*.

-In order to solve using *elimination*, either the x's or y's must "eliminate " when combining the two equations.

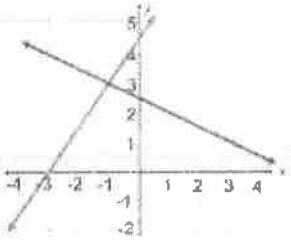
- After eliminating one variable, solve for the other.
- After solving for one variable, plug the solution back in to either equation to solve for the other.
- Your final answer will be two numbers in coordinate pair format (*x*,*y*).

V. *Word Problems:* when attempting to set up a system of equations from a word problem, follow these steps:

- First, identify the two totals. Put them at the end of the equation, after the equals signs.
- Second, identify the variables you need to find and decide how they interact (+, - , x, /) to get your totals.
- Third, identify if the variables will have any coefficients in either equation.
- Finally, solve using either elimination or substitution, whichever would be more appropriate.

Practice Problems:

❶ What is the solution to the system of equations graphed below?



A. (3, -1)

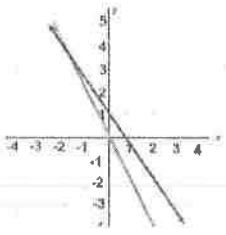
B. (-1, 3)

C. (4.5, 2.5)

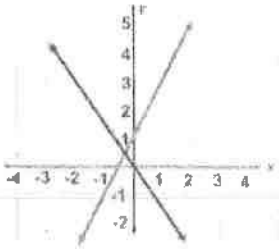
D. (-3, 2.5)

❷ Which graph shows the solution to the system of equations? $y = -2x + 1$ and $y = -\frac{3}{2}x$

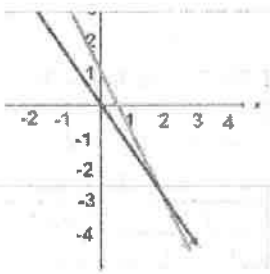
A.



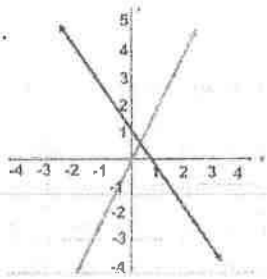
B.



C.



D.

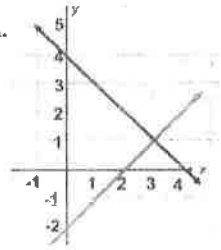


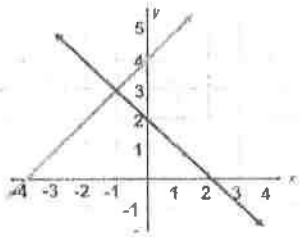
❸ What is the solution to the system of equations? $y = -2x + 1$ and $2x + 3y = 19$

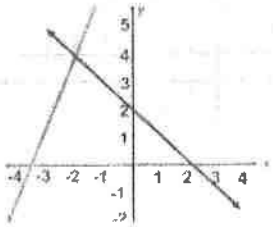
A. (-4, 9) B. (4, -7) C. (4, 9) D. (9, -4)

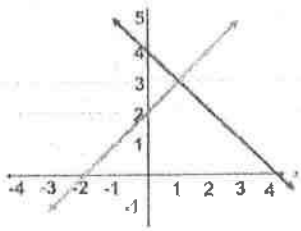
❹ Which graph shows the solution to the system of equations?

$$x + y = 4$$
$$x - y = -2$$

A. 

B. 

C. 

D. 

❺ Which step could be completed in order to prepare the system of equations below for the *elimination* method?

1st Equation: $5x - 3y = 10$
2nd Equation: $8x + 6y = 15$

A. Multiply the 1st equation by -2.
B. Multiply the 2nd equation by 2.
C. Multiply the 1st equation by 2
D. Multiply the 2nd equation by -2

❻ What is the solution to the system of equations? $y = -2x + 1$ and $y = -\frac{4}{7}x + 1$

A. (0, 1) B. (1, 0) C. (-2, 1) D. $(-2, -\frac{4}{7})$

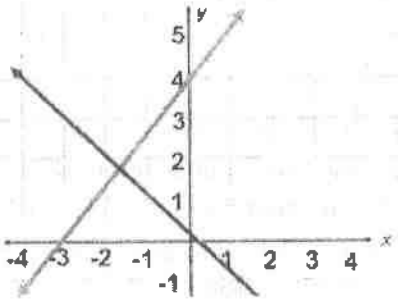
❼ What is the best estimate of the solution to the system of equations graphed below?

A. (-2.3, 1.8)

B. (-1.8, 1)

C. (-1.8, 1.8)

D. (-2.8, 1.8)



❽ In a barn there are 17 animals. Some are cows and some are ducks. There are 54 legs in all. Which system of equations below could be used to find how many cows and how many ducks are in the barn?

A. $c + d = 17$
$4c + 2d = 54$

B. $c + d = 54$
$4c + 2d = 17$

C. $c + d = 17$
$2c + 4d = 54$

D. $c + d = 17$
$4c + 2d = 6cd$

❾ The sum of two numbers is 3. Their difference is 13. What are the two numbers?

A. 8 and 5 B. 8 and -5 C. 1 and 2 D. 20 and 7

❿ Which statement is true of the system of equations shown below?

$$3x + 7y = 14$$
$$3x + 7y = 10$$

A. The system of equations has one solution: (0, 4)
B. The system of equations has one solution: (4, 0)
C. The system of equations has infinite solutions
D. The system of equations has no solutions

⓫ Which system of equations would have infinite solutions?

A. $y = 2x + 6$, $2y = 4x + 12$

B. $y = 2x + 6$, $y = 2x + 3$

C. $y = 2x + 6$, $y = -2x + 6$

D. $y = \frac{1}{2}x + 6$, $2y = 2x + 6$

⓬ What is the solution to the system of equations shown below?

$$2x + y = 10$$
$$4x + 3y = 15$$

A. (2.5, -5)
B. (7.5, -5)
C. (-5, 20)
D. (-5, 0)

Scatter Plots

MGSE8.SP.1 – Construct & Interpret Scatter Plots
MGSE8.SP.2 – Scatter Plots & Line of Best Fit
MGSE8.SP.3 – Interpret Lines of Best Fit

Scatter Plot Review Tips:

I. A *Line of Best Fit* is a line that goes through the "middle of the points the best" on a scatter plot. In general, the line should have about the same number of points above it as it does below it.
II. When making estimations about the scatter plot, look at the *Line of Best Fit* and not the individual points.
III. An association is *positive* if the points generally move up from left to right. An association is *negative* if the points generally move down from left to right.
IV. An association is *linear* if a line of best fit could be drawn through the points. An association is *nonlinear* if a line of best fit could not reasonably be drawn through the points.

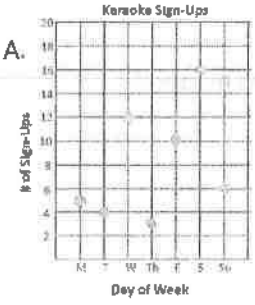
Practice Problems:

❶ The table below shows number of people signed up to sing on a karaoke stage on each night of the week. Which scatter plot best represents the table?

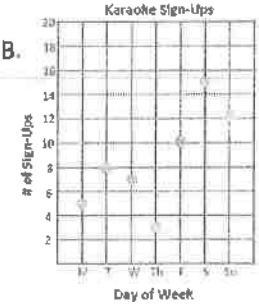
Karaoke Sign-Ups

Day of Week	# of People
Monday	5
Tuesday	4
Wednesday	7
Thursday	3
Friday	10
Saturday	15
Sunday	6

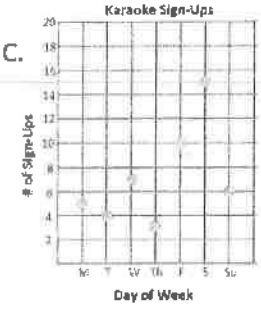
A.



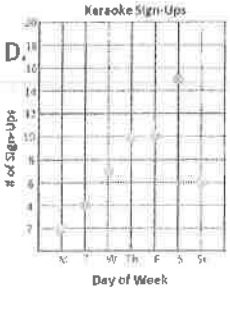
B.



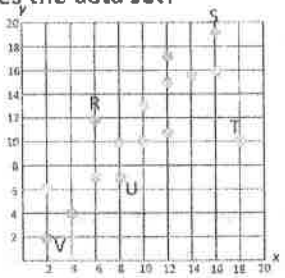
C.



D.

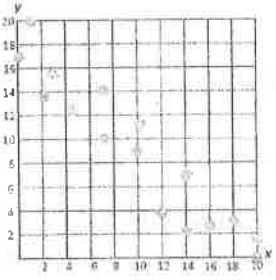


❷ Consider the scatter plot below.
Which statement best describes the data set?



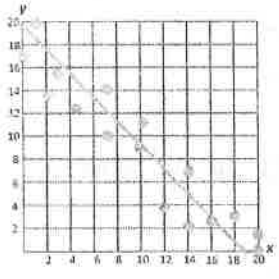
A. Positive association with point R as an outlier
B. Positive association with point T as an outlier
C. Negative association with point R as an outlier
D. Negative association with point T as an outlier

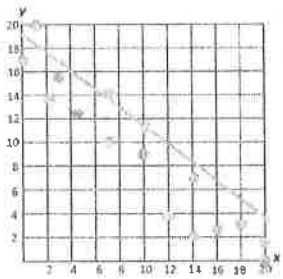
❸ Which statement best describes the association shown in the scatter plot below?

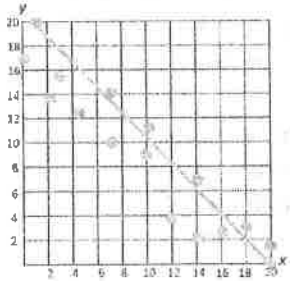


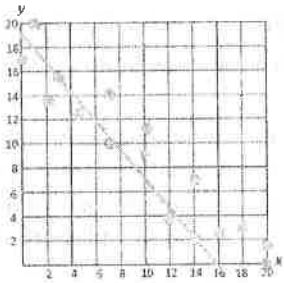
A. Positive, linear association
B. Positive, nonlinear association
C. Negative, linear association
D. Negative, nonlinear association

❹ Which shows the most accurate line of best fit?

A.


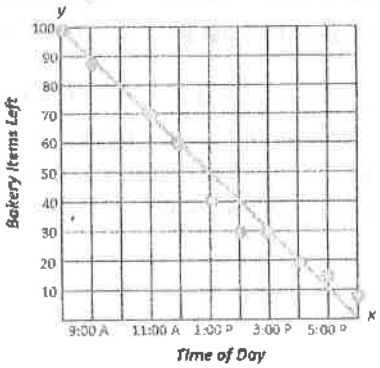
B.


C.


D.


❺ The graph below shows a line of best fit for data collected on the number of bakery items left in the bakery over the course of one day's sales.

The equation for the line of best fit is $y = -10x + 100$. What does the **y-intercept** represent?



A. The number of bakery items sold per day
B. The number of bakery items sold per hour
C. The number of bakery items in the store at the beginning of the day
D. The number of bakery items left in the store at the end of the day

❻ The average baby growth of newborn babies each month after birth is shown in the scatter plot below. The equation for the line of best fit is $y = \frac{5}{4}x + 21$. Based on the line of best fit, what length might be expected if a baby is 7 months old?

A. 21 inches

B. 30 inches

C. 29 inches

D. 32 inches

Two-Way Tables

MGSE8.SP.4 – Understanding Two-Way Tables & Relative Frequencies

Review Tips:

I. *Two-way tables* show 2 pieces of information from 1 source.
II. When looking for *trends* or *tendencies*, check to see which category holds the **majority** of its row and column.
III. When data is represented by decimals, think of them as percentages and do relative comparisons.
IV. To calculate a **relative frequency,** divide the number in category by the number in the specified total.

Practice Problems:

❶ Fifty students were asked if they played spring sports and/or fall sports. The data is listed below.
Which two-way table best represents the data given?

- 7 students do not play either sports
- 21 students play both sports
- 17 students play only fall sports
- 5 students play only spring sports

A.

	Fall Sports	No Fall Sports
Spring Sports	7	5
No Spring Sports	17	21

B.

	Fall Sports	No Fall Sports
Spring Sports	21	17
No Spring Sports	5	7

C.

	Fall Sports	No Fall Sports
Spring Sports	21	17
No Spring Sports	7	5

D.

	Fall Sports	No Fall Sports
Spring Sports	21	5
No Spring Sports	17	7

❷ The local sheriff's station has gathered data on drivers who text and drive and whether or not they have accidents. They presented their data in the table below. Which tendency does the table suggest?

A. Those who do not text and drive tend to have accidents.
B. Those who text and drive tent not to have accidents.
C. Those who text and drive tend to have accidents.
D. None of the tendencies listed are correct.

	Text & Drive	Do Not Text & Drive	Total
Accidents	48	14	62
No Car Accidents	8	30	38
Total	56	44	100

The two-way table below shows the raw data of a recent survey that compared coffee and tea drinkers. Use the table to answer equations ❸ and ❹.

	Tea	No Tea	Total
Coffee	32	48	80
No Coffee	50	10	60
Total	82	58	140

❸ Based on the data, what percent of people surveyed drink both tea and coffee?

A. 23% B. 32% C. 7% D. 40%

❹ Based on the data, what percent of tea drinkers do not also drink coffee?

A. 36% B. 61% C. 39% D. 50%