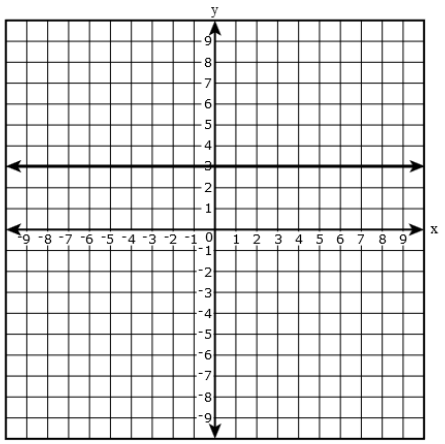
Math
Spring Operational 2015

Integrated Mathematics I
End of Year Released Items

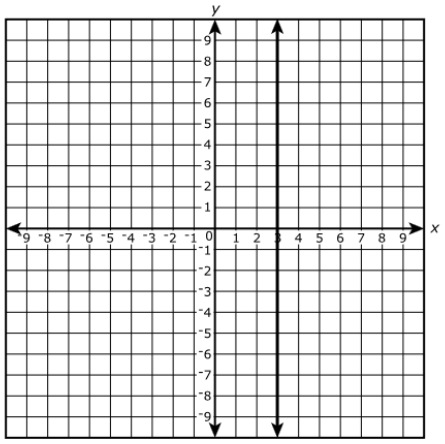
1. The function $f(x) = 2x - 3$ has a graph in the *xy*-coordinate plane.

   Select the graph that depicts the solution set of $f(x)$.

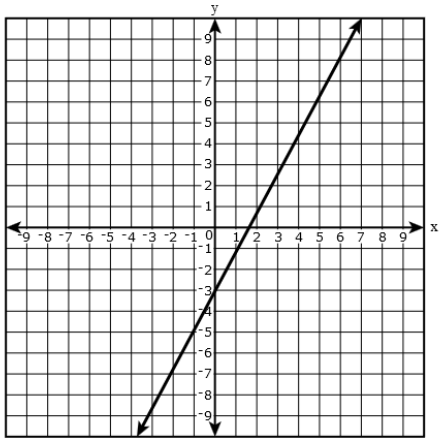
   A.



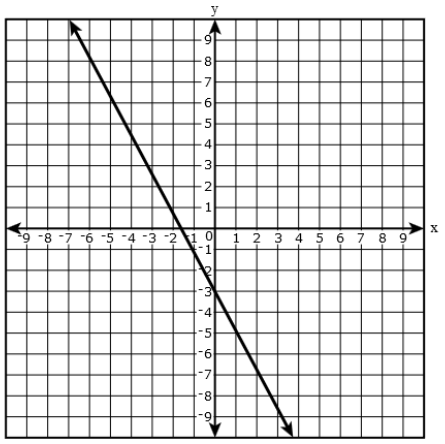
   B.



   C.



   D.



2. The table shows values for a linear function, $f(x)$.

x	$f(x)$
−1	−8
3	−5
7	−2
11	1

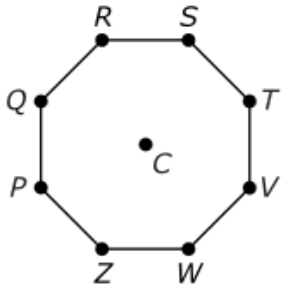
What is an equation for $f(x)$?

Drag and drop the numbers into the boxes. **Not** all numbers listed will be used.

$-\frac{29}{4}$	$-\frac{3}{4}$	$\frac{3}{4}$	$\frac{4}{3}$	$\frac{11}{4}$

$f(x) = \square\, x + \square$

3. Octagon $PQRSTVWZ$ is a regular octagon with its center at point C.

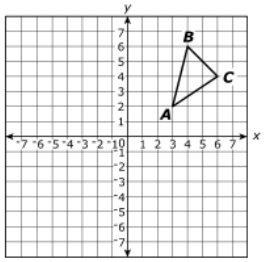


Which transformations will map octagon $PQRSTVWZ$ onto itself?

Select **each** correct transformation.

- [ ] A. reflecting over $\overline{QV}$
- [ ] B. reflecting over $\overline{RW}$
- [ ] C. reflecting over $\overline{TZ}$
- [ ] D. rotating 45° clockwise around point Z
- [ ] E. rotating 135° clockwise around point C
- [ ] F. rotating 90° counterclockwise around point C

4. Triangle *ABC* is graphed in the *xy*-coordinate plane, as shown.



Part A

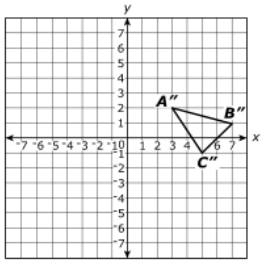
Triangle *ABC* is reflected across the *x*-axis to form triangle $A'B'C'$. What are the coordinates of C' after the reflection?

- A. $(-6, 4)$
- B. $(3, -2)$
- C. $(4, -6)$
- D. $(6, -4)$

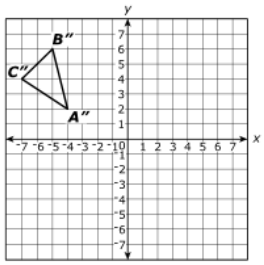
Part B

Triangle *ABC* in the *xy*-coordinate plane will be rotated 90° counterclockwise about point *A* to form triangle $A''B''C''$. Which graph represents $A''B''C''$?

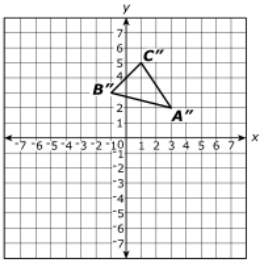
- A.



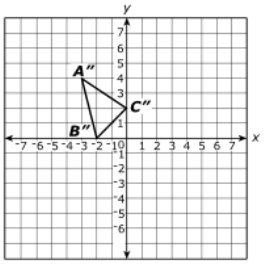
- B.



- C.



- D.



5. Four sequences are shown. The general term for each sequence is defined for a_n, where n is a positive integer. For each sequence, drag the definition that generates the sequence into the appropriate box.

$a_n = -3 - 2.5(n-1)$	$a_n = -3(-2)^{n-1}$
$a_n = 81(\frac{1}{3})^{n-1}$	$a_n = 81 - 3(n-1)$

$-3, 6, -12, 24, \ldots$	
$81, 78, 75, 72, \ldots$	
$-3, -5.5, -8, -10.5, \ldots$	
$81, 27, 9, 3, \ldots$	

6. Solve the system of equations below for x, y, and z.

$$\begin{cases} 4x - 2y + 3z = 9 \\ x - 2y = -3 \\ 2x + 3y = 1 \end{cases}$$

Enter your answers in the boxes.

$x =$ ☐ $y =$ ☐ $z =$ ☐

7. A worker earned a 2% increase in her annual salary for each of 4 years. She plans to continue working in her position for an additional n years. If she continues to earn a 2% increase in her annual salary, which statement describes the expression that can be used to calculate the total percent increase in her annual salary from the first year to the last year?

A. The expression $1.02^{(4n)}$ can be used because $(1.02^4)^n = 1.02^{(4n)}$.

B. The expression $1.02^{(4n)}$ can be used because $1.02^4 \times 1.02^n = 1.02^{(4n)}$.

C. The expression $1.02^{(4+n)}$ can be used because $1.02^4 \times 1.02^n = 1.02^{(4+n)}$.

D. The expression $1.02^{(4+n)}$ can be used because $1.02^4 + 1.02^n = 1.02^{(4+n)}$.

8. One day an e-mail is sent to 7 people. That day **each** person who receives the e-mail sends the e-mail to two friends. **Each** friend who receives the e-mail sends it to two more people on the following day. Consider an expression used to determine the number of people who receive the e-mail on day n, if the pattern continues.

Parts of the expression are shown. Interpret the meaning of **each** part of the expression by dragging it to the appropriate box. (Not all parts will be used.)

Drag and drop parts of the expression into the appropriate boxes.

2	7	2^n	$7\,(2^n)$

Initial number of people who receive the e-mail	The factor by which the number of people who receive the e-mail increases each day	The number of people who receive the e-mail on day n, where $n \geq 2$

9. **Part A**

A dump truck weighs 11.25 tons when empty. A conveyor belt pours sand into the truck at a constant rate of $\frac{1}{4}$ ton per minute until it is full. Let t represent the elapsed time in minutes. Let w represent the weight of the truck after t minutes.

Write an equation for w in terms of t.

Enter your equation in the space provided. Enter **only** your equation.

$w(t) = \square$

Part B

The dump truck from Part A weighs 18 tons when filled. At the same time the dump truck is being filled, an identical dump truck filled to capacity is being emptied at a rate of $\frac{1}{8}$ ton per minute.

How much sand is in each dump truck when the trucks are the same weight?

Enter your answer in the box.

[ ] tons

10. A total of 160 students were surveyed from the countries of Australia, Canada, and the United Kingdom. One of the questions asked students to report which hand they considered to be their most dominant. Results are shown in the table.

	Right-Hand Dominant	Left-Hand Dominant	Total
Australia	68	11	79
Canada	46	6	52
United Kingdom	25	4	29
Total	139	21	160

Select an option from each drop-down menu to complete the sentence.

The country [Choose...] had the greatest percentage of its students report being right-hand

- Australia
- Canada
- United Kingdom

dominant with approximately [Choose..] .

- 68%
- 86%
- 88%

11. The value, V, of an investment is given by the function $V(t)$, where t is the number of years since 1995 and V is measured in thousands of dollars. Which equation indicates that the investment had a value of $8,000 in 2005?

A. $V(8) = 10$

B. $V(10) = 8$

C. $V(8{,}000) = 2005$

D. $V(2005) = 8{,}000$

12. Carson is a high school student with two part-time jobs. He earns $6 per hour for babysitting, and he earns $8 per hour doing clerical work for his father's business. His goal is to earn at least $96 a week, but because of school, he does not want to work more than 15 hours each week.

Part A

Let b represent the number of hours Carson works in one week at the babysitting job, and let c represent the number of hours Carson works in one week at his father's business. Which inequalities represent the constraints on what Carson can earn and the number of hours he can work in one week?

Select **all** that apply.

- ☐ A. $b + c \leq 15$
- ☐ B. $6b + 8c \leq 15$
- ☐ C. $6b + 8c \geq 15$
- ☐ D. $b + c \geq 96$
- ☐ E. $6b + 8c \geq 96$
- ☐ F. $6b + 8c \leq 96$

Part B

Which combination of numbers of hours would allow Carson to work 15 hours in one week and earn at least $96 ?

Select **all** that apply.

- ☐ A. 10 hours babysitting and 5 hours clerical
- ☐ B. 11 hours babysitting and 4 hours clerical
- ☐ C. 12 hours babysitting and 3 hours clerical
- ☐ D. 13 hours babysitting and 2 hours clerical
- ☐ E. 14 hours babysitting and 1 hour clerical

Part C

Suppose Carson worked as a babysitter for 5 hours one week. What is the minimum number of **full** hours he would need to work at his father's business to earn at least $96 that week?

Enter your answer in the box.

[ ] hours

Part D

Suppose Carson worked at his father's business for 8 hours one week. What is the minimum number of **full** hours he would need to babysit that week to earn at least $96 that week?

Enter your answer in the box.

[ ] hours

13. Jamie has a plan to save money for a trip. Today, she puts 5 pennies in a jar. Tomorrow, she will put the initial amount in plus another 5 pennies. Each day she will put 5 pennies more than she put into the jar the day before, as shown in the table.

Day	0	1	2	3
Deposit (pennies)	5	10	15	20

Part A

Let $f(d)$ represent the amount of pennies she puts into the jar on day d. What does $f(10) = 55$ mean?

- A. Jamie will put 10 pennies in the jar on day 55.
- B. Jamie will put 55 pennies in the jar on day 10.
- C. Jamie will have 10 pennies in the jar on day 55.
- D. Jamie will have 55 pennies in the jar on day 10.

Part B

Let $f(d)$ represent the amount of pennies that Jamie puts into the jar on day d. Today is day 0.

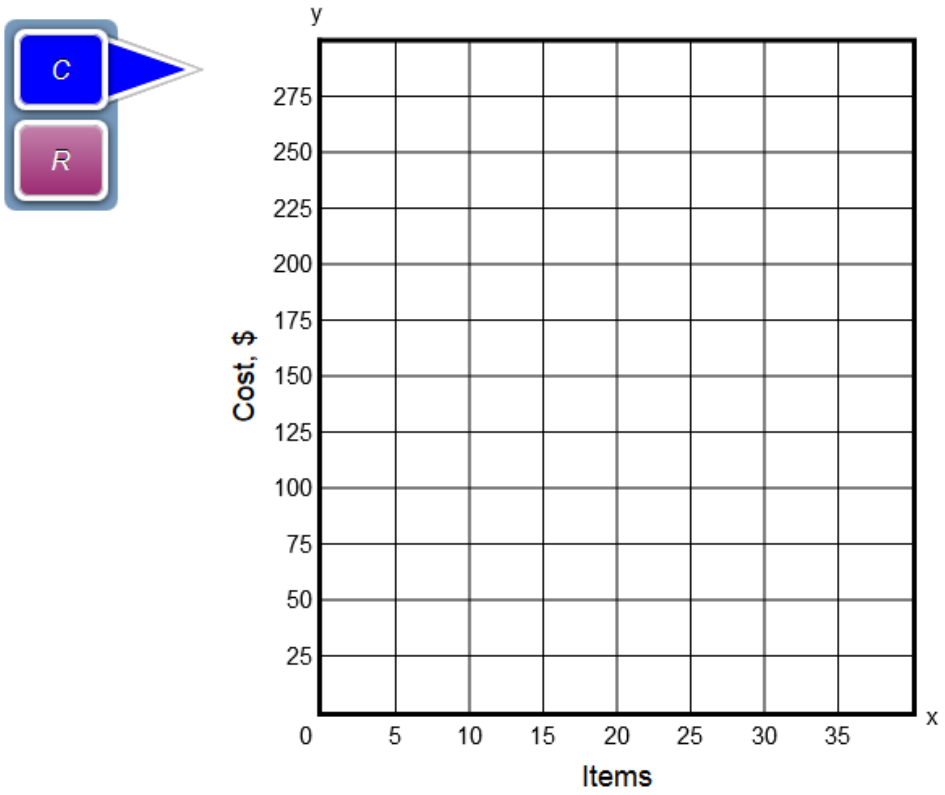
Select the statement that is true.

- A. $f(d+1) = f(d)$
- B. $f(d+1) = 5(f(d))$
- C. $f(d+1) = f(d) + 1$
- D. $f(d+1) = f(d) + 5$

14. A small company manufactures a certain item and sells it online. The company has a business model where the cost C, in dollars, to make x items is given by the equation $C = \frac{20}{3}x + 50$ and the revenue R, in dollars, made by selling x items is given by the equation $R = 10x$. The break-even point is the point where the cost and revenue equations intersect.

Part A

Graph the cost and revenue equations on the *xy*-coordinate plane provided. Plot two points, then a line will connect the points.



Part B

How many items must the company sell to break even?

Enter your answer in the box.

15. Tonya's class planted sunflowers and the students are tracking the growth of their individual plants. The table shows the height of Tonya's plant t days after she planted her sunflower seed.

Time (days)	Height (inches)
10	4
20	8
30	12
40	16

Part A

If the growth of the sunflower continues at the same rate, what is the expected height, in inches, on day 55?

Enter your answer in the box.

[ ] inches

Part B

Based on the data in the table, which function is an appropriate model for the height, h, in inches, at time t?

A. $h(t) = 4t$

B. $h(t) = \frac{1}{4}t$

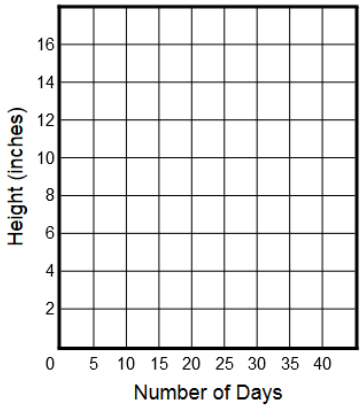
C. $h(t) = \frac{5}{2}t$

D. $h(t) = \frac{2}{5}t$

Part C

On the given *xy*-coordinate plane, graph $h(t)$.

To graph a line, select two points on the coordinate plane. A line will be drawn through the points.



Part D

What is an appropriate domain for the function in context?

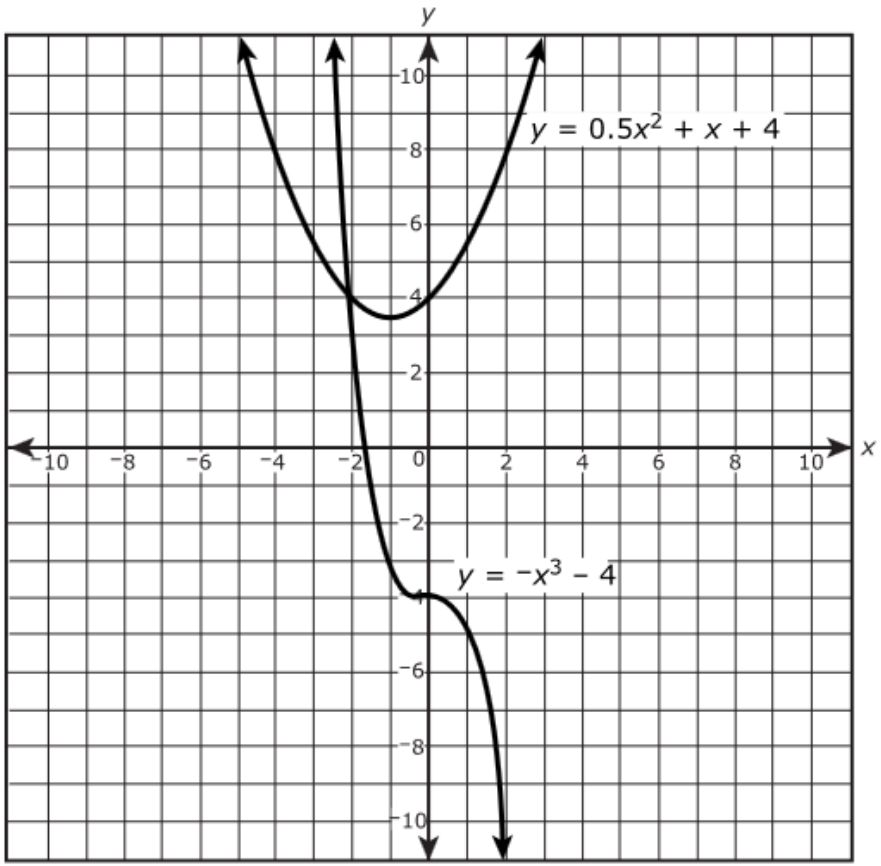
A. integers only

B. nonnegative integers only

C. all real numbers

D. all nonnegative real numbers

16. The graphs of $f(x) = -x^3 - 4$ and $g(x) = 0.5x^2 + x + 4$ are given.



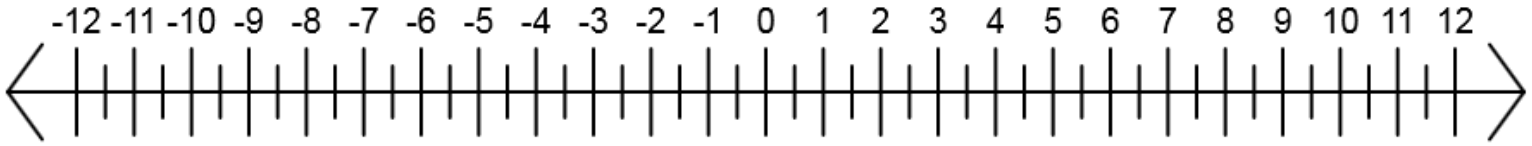
Use the graphs to find the solution to the equation $-x^3 - 4 = 0.5x^2 + x + 4$.

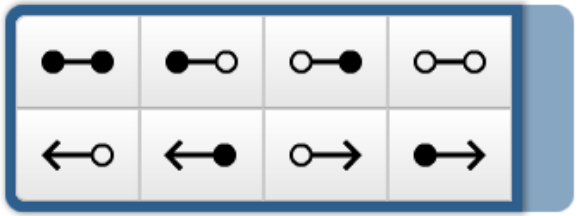
Enter your answer in the box.

$x =$ ☐

17. Solve $4 - \frac{2}{3}x > 2 - x$ for x. Plot the solution set on the number line.

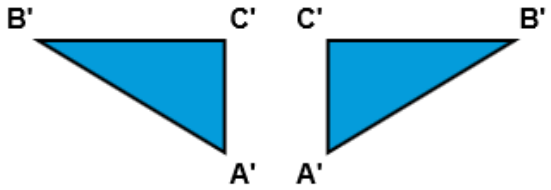
Select a solution set indicator. Then, select the number line and drag the point(s) to appropriate location(s).

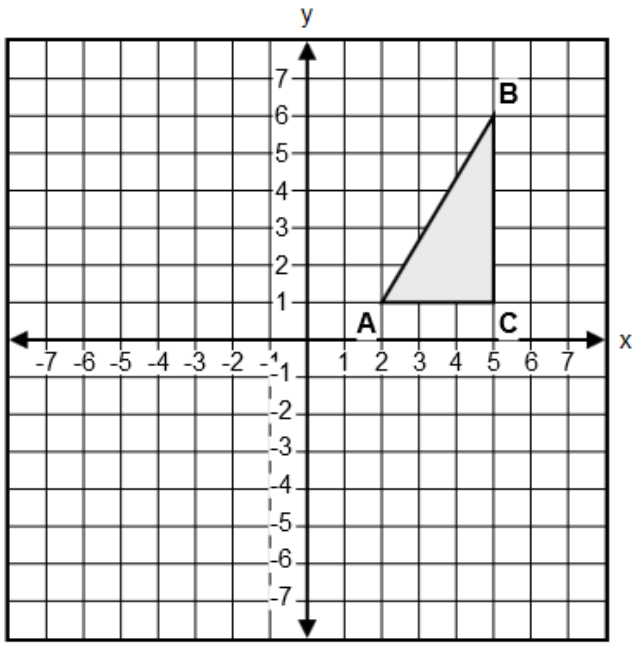




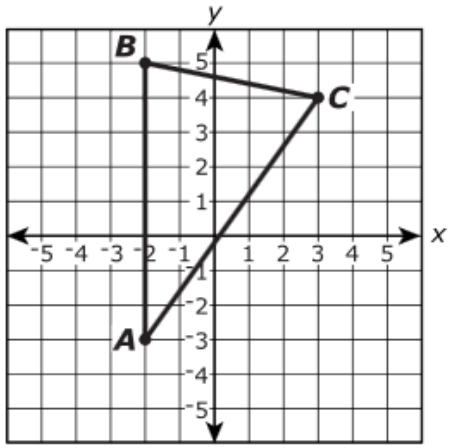
18. The right triangle in the coordinate plane is rotated 270° clockwise about the point $(2, 1)$ and then reflected across the *y*-axis to form triangle $A'B'C'$.

Drag and drop the appropriate orientation for triangle $A'B'C'$ into the correct position on the coordinate plane.





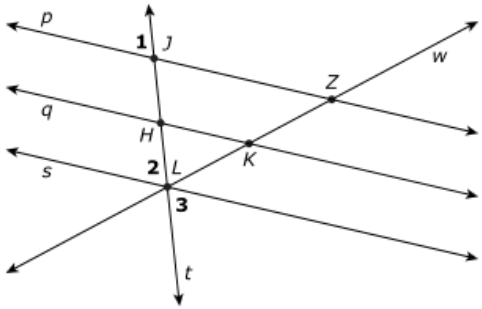
19.



Triangle ABC is shown in the *xy*-coordinate plane. The triangle will be translated 2 units down and 3 units right to create triangle $A'B'C'$. Indicate whether each of the listed parts of the image will or will not be the same as the corresponding part in the preimage (triangle ABC) by selecting the appropriate box in the table.

	Will be the Same	Will Not be the Same
The coordinates of A'	☐	☐
The coordinates of C'	☐	☐
The perimeter of $\triangle A'B'C'$	☐	☐
The area of $\triangle A'B'C'$	☐	☐
The measure of $\angle B'$	☐	☐
The slope of $\overline{A'C'}$	☐	☐

20. In the figure, $p \parallel s$. Transversals t and w intersect at point L.



Part A

Statement	Reason
1) $p \parallel s$	Given
2) $\angle 1 \cong \angle 2$	Corresponding angles along parallel lines are congruent.
3) $\angle 2 \cong \angle 3$	?
4) $\angle 1 \cong \angle 3$	Congruence of angles is transitive.

What is the missing reason in step 3?

A. Alternate interior angles along parallel lines are congruent.

B. Alternate exterior angles along parallel lines are congruent.

C. Corresponding angles along parallel lines are congruent.

D. Vertical angles are congruent.

Part B

Consider the proof of $p \parallel q$ given that $\triangle LHK \sim \triangle LJZ$.

If $\triangle LHK \sim \triangle LJZ$, then $\angle LHK \cong \angle LJZ$ because corresponding angles in similar triangles are congruent.

Which statement concludes the proof?

A. If $\angle LHK \cong \angle LJZ$, then $p \parallel q$ because when base angles are congruent, the lines are parallel.

B. If $\angle LHK \cong \angle LJZ$, then $p \parallel q$ because when corresponding angles are congruent, the lines are parallel.

C. If $\angle LHK \cong \angle LKH$, then $p \parallel q$ because when alternate exterior angles are congruent, the lines are parallel.

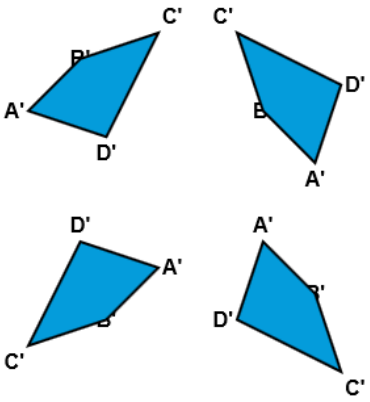
D. If $\angle JLZ \cong \angle HLK$, then $p \parallel q$ because when corresponding angles are congruent, the lines are parallel.

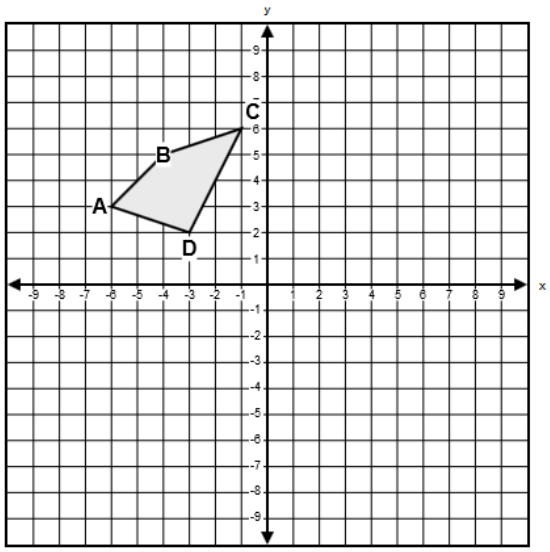
21. Quadrilateral *ABCD* is shown graphed in the *xy*-coordinate plane.

Part A

Quadrilateral *ABCD* will be translated according to the rule $(x, y) \rightarrow (x + 3, y - 4)$ to form $A'B'C'D'$.

Select the correct orientation of $A'B'C'D'$ and place it correctly in the plane.

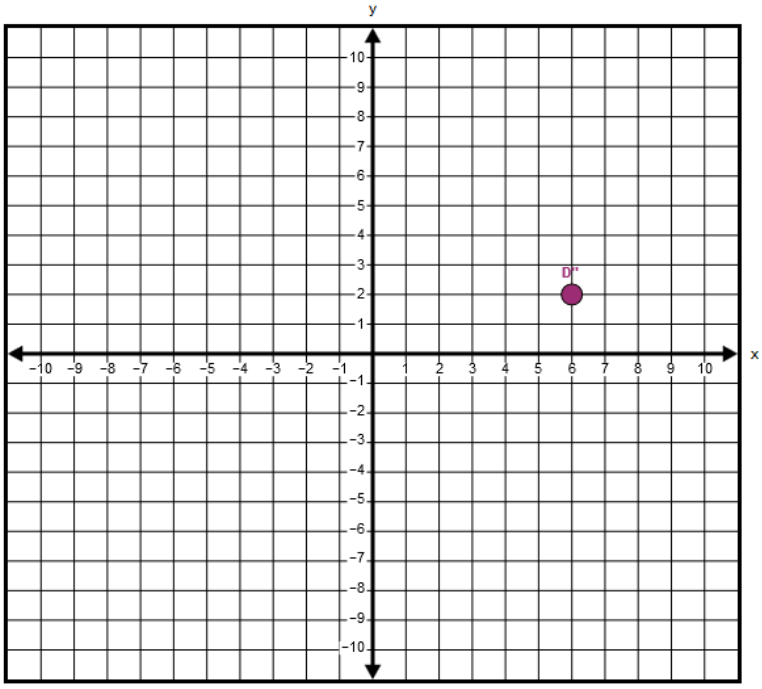




Part B

Quadrilateral *ABCD* maps onto $A''B''C''D''$. It will undergo a different transformation that will map $A(-6, 3)$ to A'', $B(-4, 5)$ to B'', $C(-1, 6)$ to C'', and $D(-3, 2)$ to D''. The transformation will consist of a reflection over the *y*-axis followed by a translation. Point D'' is shown plotted in the plane after the transformation.

Plot the point A'' in the plane.



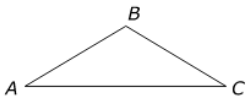
22. Which geometric figures have a measurable quantity?

Select **each** correct answer.

- [ ] A. line
- [ ] B. angle
- [ ] C. point
- [ ] D. line segment
- [ ] E. ray

23.

Given: In $\triangle ABC$ shown, $\overline{BA} \cong \overline{BC}$.



Prove: $\angle A \cong \angle C$

Statement	Reason
1)	1) Given
2)	2)
3)	3) Definition of midpoint
4)	4)
5)	5)
6)	6)

Part A

Select from the drop-down menus to correctly complete step 2 of the proof.

Choose... because Choose... .

let D be the midpoint of line segment AB
let D be the midpoint of line segment AC
let D be the midpoint of line segment BC

every line has exactly one midpoint
every segment has exactly one midpoint
every triangle has exactly one midpoint

Part B

Select from the drop-down menus to correctly complete step 4 of the proof.

Choose... because of the Choose... .

angle ADB is congruent to angle CDB
triangle ADB is congruent to triangle CDB
line segment BD is congruent to line segment BD

reflexive property of congruence
definition of perpendicular bisector
Side Angle Side congruence postulate

Part C

Select from the drop-down menus to correctly complete step 5 of the proof.

Choose... because of the

triangle ABD is similar to triangle CBD
triangle ABD is congruent to triangle CBD
angle ABD is congruent to angle CBD

Angle Angle similarity postulate
Side Side Side congruence postulate
Side Angle Side congruence postulate

Part D

What is the correct reason for the statement in step 6?

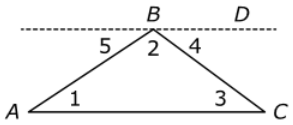
- A. the transitive property of congruence
- B. base angles of isosceles triangles are congruent
- C. corresponding parts of congruent triangles are congruent
- D. vertical angles are congruent

24. Triangle JKL will undergo a transformation to create triangle $J'K'L'$ in the *xy*-coordinate plane. Which transformations will result in $\triangle JKL \cong \triangle J'K'L'$?

Select **all** that apply.

- [ ] A. $(x, y) \rightarrow (-x, -y)$
- [ ] B. $(x, y) \rightarrow (-x, y)$
- [ ] C. $(x, y) \rightarrow (x, y - 5)$
- [ ] D. $(x, y) \rightarrow (x + 3, y - 5)$
- [ ] E. $(x, y) \rightarrow (2x, 3y)$
- [ ] F. $(x, y) \rightarrow (-x, y + 3)$

25. An incomplete proof of the theorem that the sum of the interior angles of a triangle is 180° is shown.



Given: $\triangle ABC$

Prove: $m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ$

Statement	Reason
1) Draw line *BD* parallel to line *AC*	1)
2)	2)
3) $m\angle 2 + m\angle 4 = m\angle ABD$; $m\angle 5 + m\angle ABD = 180^\circ$	3) Angle addition postulate
4) $m\angle 5 + m\angle 2 + m\angle 4 = 180^\circ$	4) Substitution property of equality
5) $m\angle 1 + m\angle 2 + m\angle 3 = 180^\circ$	5)

Part A

What is the appropriate reason for the statement in step 1 ?

- A. Through any two points, there is exactly one line.
- B. Through a point not on a line, there is exactly one line parallel to the given line.
- C. If two lines cut by a transversal form congruent corresponding angles, then the lines are parallel.
- D. If two lines cut by a transversal form congruent alternate interior angles, then the lines are parallel.

Part B

Which pairs of angle congruences or equalities should be used for the statement in step 2 ?

Indicate **all** such pairs.

- A. $\angle 1 \cong \angle 2$ or $m\angle 1 = m\angle 2$
- B. $\angle 1 \cong \angle 3$ or $m\angle 1 = m\angle 3$
- C. $\angle 1 \cong \angle 4$ or $m\angle 1 = m\angle 4$
- D. $\angle 1 \cong \angle 5$ or $m\angle 1 = m\angle 5$
- E. $\angle 2 \cong \angle 3$ or $m\angle 2 = m\angle 3$
- F. $\angle 2 \cong \angle 4$ or $m\angle 2 = m\angle 4$
- G. $\angle 2 \cong \angle 5$ or $m\angle 2 = m\angle 5$
- H. $\angle 3 \cong \angle 4$ or $m\angle 3 = m\angle 4$

Part C

Select from the drop-down menu to correctly complete the sentence.

The reason for the statement in step 2 is that Choose... .

If two parallel lines are cut by a transversal, then alternate interior angles are congruent
If two parallel lines are cut by a transversal, then corresponding angles are congruent
It two lines cut by a transversal form congruent corresponding angles, then the lines are parallel
It two lines cut by a transversal form congruent alternate interior angles, then the lines are parallel

Part D

Select from the drop-down menu to correctly complete the sentence.

The appropriate reason for the statement in step 5 is the Choose... .

Reflexive property of equality
symmetric property of equality
transitive property of equality
substitution property of equality