Math
Spring Operational 2015

Integrated Mathematics II
End of Year Released Items

VF581872

1. Select from the drop-down menus to correctly complete the sentences.

The sum $\frac{1}{3} + \frac{\sqrt{5}}{3}$ is [Choose... / rational / irrational] because the sum [Choose... / can / cannot] be expressed as a single fraction with a rational numerator and a rational denominator.

The quotient $\frac{20}{\sqrt{16}}$ is [Choose... / rational / irrational] because the quotient [Choose... / has a square root in its denominator / is equal to an integer].

M40946

2. A company has developed a new video game console. After completing cost analysis and demand forecasts, the company has determined that the profit function for the new console is $f(g) = -250g^2 + 70{,}000g - 4{,}570{,}000$ where g is the number of consoles sold. What is the domain of the profit function?

A. all integers

B. all rational numbers

C. all integers greater than or equal to 0

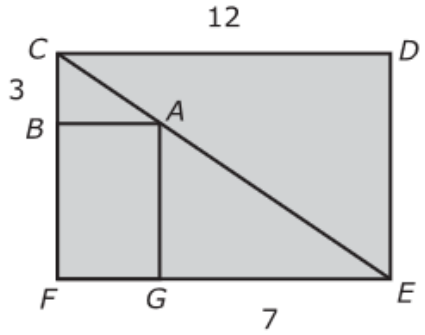
D. all rational numbers greater than or equal to 0

3. A dilation with a center at $P(0, 0)$ and a scale factor k is applied to $\overline{MN}$. Let $\overline{M'N'}$ represent the image of $\overline{MN}$ after the dilation.

Select **each** correct statement.

- ☐ A. If $k > 0$, then $M'N' > MN$.
- ☐ B. If $k > 1$, then $M'N' > MN$.
- ☐ C. If $0 < k < 1$, then $M'N' < MN$.
- ☐ D. If $0.5 < k < 1.5$, then $M'N' < MN$.
- ☐ E. If $k = 1$, then $M'N' = MN$.
- ☐ F. If $k = 0.5$, then $M'N' = 0.5(MN)$.

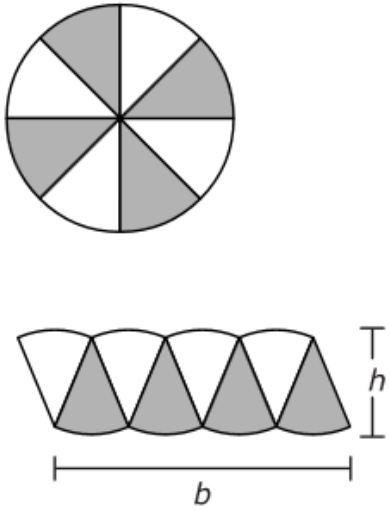
4. In the diagram, quadrilaterals $FBAG$ and $CDEF$ are rectangles.



How long is $\overline{DE}$ rounded to the nearest tenth?

Enter your answer in the box.

5.



The figure illustrates an informal argument for the formula for the area of a circle. The circle is divided into congruent sectors, and the sectors are rearranged to form a shape that resembles a parallelogram, as shown. As the number of sectors increases, the rearranged shape more closely resembles a parallelogram with area A, given by the formula $A = bh$, where b is the base and h is the height of the parallelogram.

Select the correct value for b and h to develop the area of a circle in terms of r, the radius of the circle.

$b =$ Choose... , $h =$ Choose...

b =	h =
π	π
r	r
πr	r x r
2π	2r
2πr	2π

6. Which of the following is equivalent to $(i+3)+i(2i-4)$?

- A. $-5i+1$
- B. $-i+3$
- C. $i-3$
- D. $-3i+1$

7. A rectangular garden has a length that is 3 feet longer than its width. Let *w* represent the width of the garden, in feet. The entire garden is surrounded by a 2-foot-wide cement walkway. What does the algebraic expression $(w+4)(w+7)$ represent in this context?

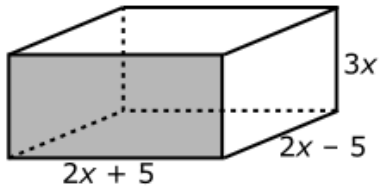
   A. the area of the garden only

   B. the total area of the garden and walkway

   C. the perimeter of the garden only

   D. the perimeter of the walkway only

8. The diagram represents a right rectangular prism with dimensions labeled as algebraic expressions.

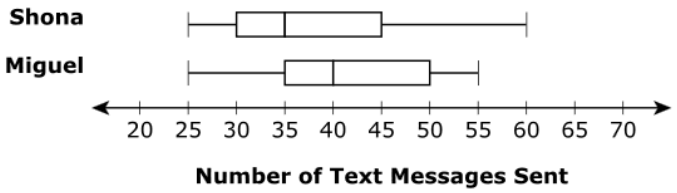


Which of these expressions represents the volume of the prism?

Select **all** that apply.

- ☐ A. $7x$
- ☐ B. $4x^2 - 25$
- ☐ C. $12x^3 - 75x$
- ☐ D. $3x\left(4x^2 - 25\right)$
- ☐ E. $(2x + 5)(6x^2 - 15x)$
- ☐ F. $12x^3 + 60x^3 + 75x$
- ☐ G. $12x^3 - 30x^3 + 10x - 25$

9. For a school project, two students, Shona and Miguel, recorded the number of text messages each of them sent each day for a 60-day period. The box plots summarize the recorded data.



Part A

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

The median of Miguel's data is [Choose...] the median of Shona's data, and the range of Miguel's data is [Choose...] the range of Shona's data.

- greater than
- less than
- equal to

Part B

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

Approximately [Choose...] of Miguel's data values are greater than the median of Shona's data.

- 5%
- 10%
- 20%
- 25%
- 50%
- 75%

Part C

Which of the statements can be concluded from the box plots?

Select **all** that apply.

- ☐ A. For approximately 15 days, Miguel sent 50 or more text messages per day.
- ☐ B. For at least 5 days, Shona sent 55 or more text messages per day.
- ☐ C. There was at least one day on which Shona sent 40 text messages.
- ☐ D. The number of days on which Shona sent more text messages than Miguel is greater than 30.
- ☐ E. Shona and Miguel each sent 25 text messages on the same day.

Part D

There are different methods of identifying outliers in a set of data values. One method is described.

- Multiply the interquartile range by 1.5.
- Add the result to the third quartile to determine the upper limit, and subtract the result from the first quartile to determine the lower limit.
- Any value greater than the upper limit or less than the lower limit is considered an outlier.

On the 61st day, Shona sent t text messages, which will be considered an outlier based on the described method. Which number could be the value of t?

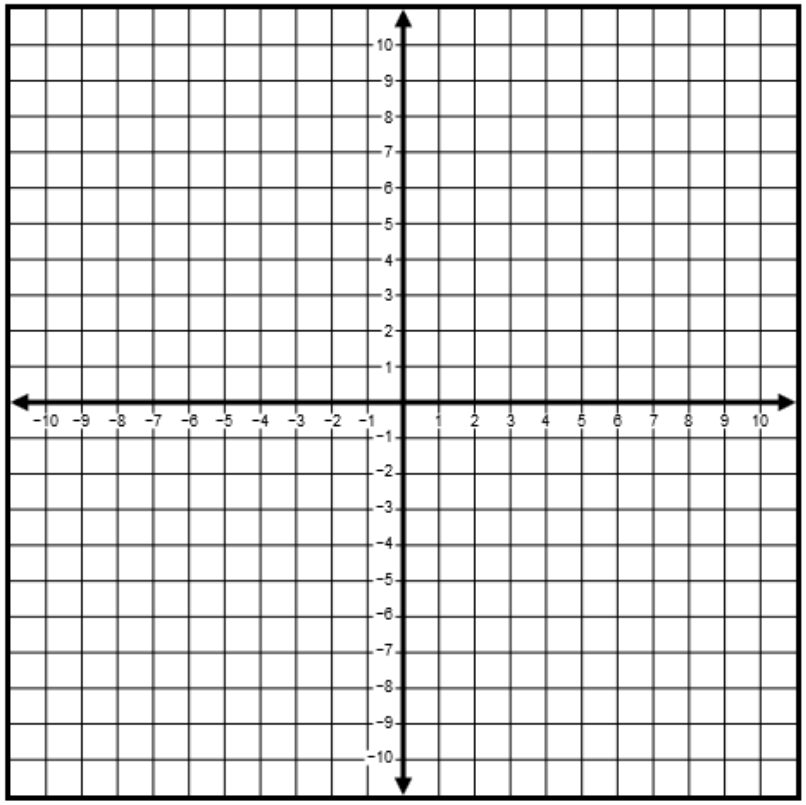
Select **all** that apply.

- ☐ A. 5
- ☐ B. 10
- ☐ C. 15
- ☐ D. 65
- ☐ E. 75

10. An absolute value function in the form $f(x) = a|x + b| + c$ is graphed in the *xy*-coordinate plane, where a, b, and c are constants.

Select the Absolute Value button and then drag the points to show the graph $f(x) = -|2x - 6| + 1$.

Absolute Value



11. Select from the drop-down menus to correctly complete the sentence.

To solve the equation $x^2 - x - 2 = 0$ for x by completing the square, a student could use the equivalent equation $(x -$ Choose.. $)^2 =$ Choose.. .

-1/4
1/4
-1/2
1/2
-9/4
9/4
-3/2
3/2

-1/4
1/4
-1/2
1/2
-9/4
9/4
-3/2
3/2

12. Choose the expressions that are equivalent to $x^2 + 4x + 3$.

Select **all** that apply.

- [ ] A. $(x + 2)^2 - 1$
- [ ] B. $(x + 2)^2 + 1$
- [ ] C. $(x - 1)(x - 3)$
- [ ] D. $(x + 1)\ (x + 3)$
- [ ] E. $(x - 1)(x + 4)$

13. The parabola $f(x) = (x-2)^2 + 1$ is graphed in the *xy*-coordinate plane.

Part A

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

The vertex of the parabola is 2 units [Choose...] the origin and 1 unit [Choose...] the origin.

- Choose...
  - up from
  - down from
  - right of
  - left of
- Choose...
  - up from
  - down from
  - right of
  - left of

Part B

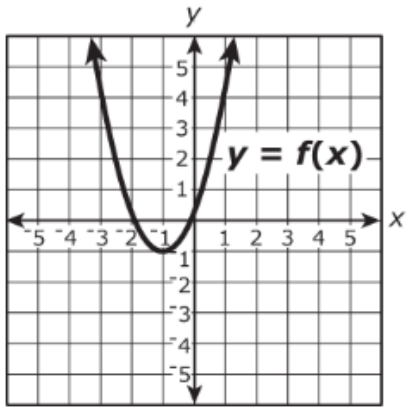
Select from the drop-down menus to correctly complete the sentence.

How does the function $f(x+3)$ compare to $f(x)$?

$f(x+3)$ has a [Choose...] shift 3 units [Choose...] $f(x)$.

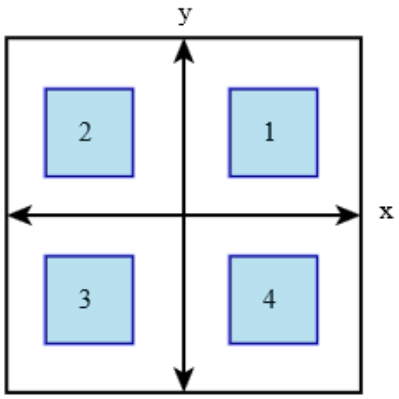
- Choose...
  - vertical
  - horizontal
- Choose...
  - up from
  - down from
  - right of
  - left of

14. A quadratic function $f(x)$ is graphed in the *xy*-coordinate plane.



In which quadrant would the vertex of $f(x+3)+2$ be located?

Select the correct quadrant.



VH002426

15. Consider the function $f(x) = x^2 + bx - 16$, where b is a constant.

Part A

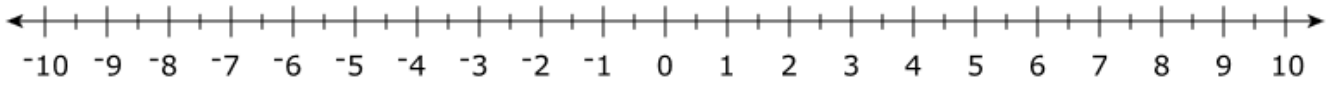
If the function has an axis of symmetry at $x = 5$, what is the value of b?

Enter your answer in the box.

Part B

If $b = -6$, what are the zero(s) of the function?

Select the location(s) to plot the zero(s) on the number line.



M40097

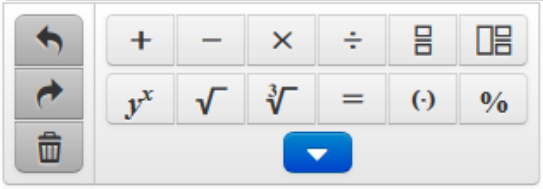
16. What is the sum of the roots of the equation $2x^2 + 5x - 3 = 0$?

- A. -3.5
- B. -2.5
- C. -1.5
- D. 2.5

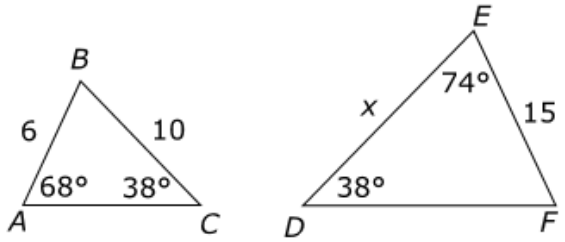
17. The area, A, of a rectangular parking lot is given by the equation $A = 16s^2 + 25$. Jacob knows the area of the parking lot and wants to find s. Solve $A = 16s^2 + 25$ for s.

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

$s =$ ☐



18. Given the two triangles shown, find the value of x.

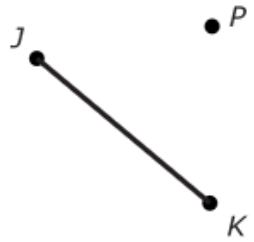


Select from the drop-down menu to correctly complete the sentence.

The value of x is Choose... .

- 4
- 11
- 12
- 19
- 20
- 25

19. The figure shows line segment JK and a point P that is not collinear with points J and K.



Suppose that line segment $J'K'$ is the image of line segment JK after a dilation with scale factor 0.5 that is centered at point P. Which statement **best** describes the position of line segment $J'K'$?

A. Line segment $J'K'$ is parallel to line segment JK.

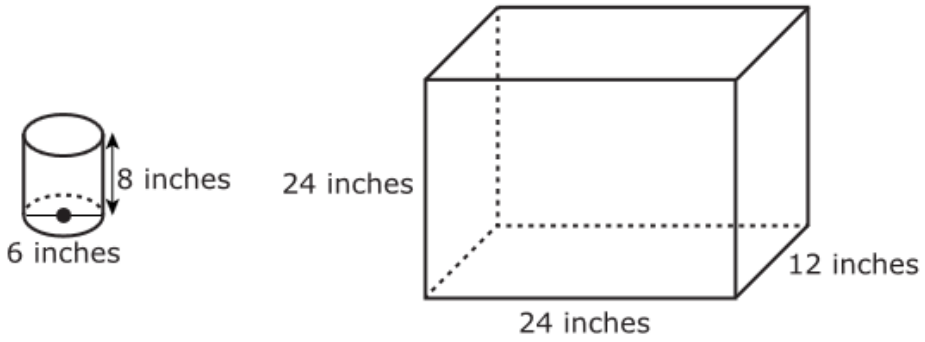
B. Line segment $J'K'$ is perpendicular to line segment JK.

C. Line segment $J'K'$ intersects line segment JK at one point, but it is not perpendicular to line segment JK.

D. Line segment $J'K'$ lies on the same line as line segment JK.

M40994

20. The given cylindrical container is used to fill the rectangular prism fish tank with water.



What is the **least** number of full cylindrical containers needed to completely fill the fish tank?

Enter your answer in the box.

[ ] containers

VF902282

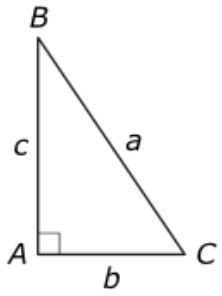
21. Triangle APQ is the image of $\triangle ABC$ under a dilation centered at vertex A with scale factor $\frac{1}{2}$. Triangle RBT is the image of $\triangle ABC$ under a dilation centered at vertex B with scale factor $\frac{3}{4}$. Which statement about $\triangle ABC$, $\triangle APQ$, and $\triangle RBT$ is correct?

- A. All three triangles are similar.
- B. None of the triangles are similar.
- C. Triangles APQ and RBT are not similar because they were dilated using different scale factors.
- D. Triangles APQ and RBT are not similar because they were dilated with different centers of dilation.

22. A computer monitor is 20 inches wide. The aspect ratio, which is the ratio of the width of the screen to the height of the screen, is 16:9. What is the length of the diagonal of the screen, to the nearest whole inch?

Enter your answer in the box.

23. The figure shows right $\triangle ABC$.

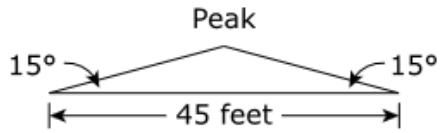


Which of the listed values are equal to the sine of B?

Select **all** that apply.

- ☐ A. $\frac{b}{c}$
- ☐ B. $\frac{c}{a}$
- ☐ C. $\frac{b}{a}$
- ☐ D. the cosine of B
- ☐ E. the cosine of C
- ☐ F. the cosine of $(90^\circ - B)$
- ☐ G. the sine of $(90^\circ - C)$

24. A carpenter is constructing a triangular roof for a storage shed as shown in the figure.



Part A

How high will the peak of the roof rise above the top of the shed?

Give your answer to the nearest foot.

Enter your answer in the box.

[ ] feet

Part B

After the roof is constructed, it will be covered with an asphalt roofing material. The carpenter needs to calculate the combined length of the two sloping sides. What will be the total length needed of the roof covering?

Give your answer to the nearest foot.

Enter your answer in the box.

[ ] feet

VH001699

25. For $m > 0$, the expression $\frac{2(\sqrt{m})^3}{\sqrt[4]{m}}$ can be rewritten in the form $2m^a$, where a is a fraction.

What is the value of a?

Enter your answer in the boxes.

$\square$

$\frac{\square}{\square}$

VH002816

26. An expression is given.

$$\frac{(3x)}{(3x)^{\frac{3}{2}}}$$

If $x > 0$, which of the expressions listed is equivalent to the expression given?

Select **all** that apply.

- ☐ A. $\frac{1}{3x}$
- ☐ B. $\frac{1}{\sqrt{3x}}$
- ☐ C. $\frac{1}{3\sqrt{x}}$
- ☐ D. $(3x)^{\frac{1}{2}}$
- ☐ E. $(3x)^{-\frac{1}{2}}$

27. Two functions are shown.

$$f\left(x\right) = x^2$$

$$g(x) = 3 - x$$

Fill in **each** coefficient to complete the definition of $2f(1-x) - 3g(x)$.

Enter your answers in the boxes.

$2f(1-x) - 3g(x) =$ [ ] $x^2 +$ [ ] $x +$ [ ]

28. Students at the local high school were asked about their food preferences. Of the 437 students polled, 306 like hamburgers, 153 like chicken, and 47 like both. One student will be selected at random from the 437 students polled.

Part A

What is the probability that the selected student will like **neither** hamburgers nor chicken? Give your answer as a fraction.

Enter your answer in the boxes.

$\frac{\square}{\square}$

Part B

Let H represent the event that the student selected is one who likes hamburgers, and let $P(H)$ represent the probability that event H will occur. Let C represent the event that the student selected is one who likes chicken, and let $P(C)$ represent the probability that event C will occur.

Which statement is true?

A. Events H and C are independent because $P(H \text{ and } C) = P(H) \cdot P(C)$.

B. Events H and C are independent because $P(H \text{ and } C) \neq P(H) \cdot P(C)$.

C. Events H and C are **not** independent because $P(H \text{ and } C) = P(H) \cdot P(C)$.

D. Events H and C are **not** independent because $P(H \text{ and } C) \neq P(H) \cdot P(C)$.

29. Which of the equations have only real solutions?

Select **each** equation with real solutions.

- [ ] A. $(x-7)^2=0$
- [ ] B. $3x^2+7=4x$
- [ ] C. $x=\frac{3\pm\sqrt{-3}}{2}$
- [ ] D. $x=\frac{-18\pm\sqrt{18^2-4(3)(4)}}{2(3)}$
- [ ] E. $(x+2)(x-6)=-18$
- [ ] F. $x^2+8x=-8$