

Massachusetts MCAS Grade 10 Math Practice

**Exam Materials
Pages 2 - 34**

**Answer Key Materials
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PRACTICE TEST

Mathematics

Grade 10

Student Name

School Name

District Name



Grade 10 Mathematics

SESSION 1

This session contains 13 questions.

*You may use your reference sheet during this session.
You may **not** use a calculator during this session.*



Directions

Read each question carefully and then answer it as well as you can. You must record all answers in this Practice Test Booklet.

For some questions, you will mark your answers by filling in the circles in your Practice Test Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

For other questions, you will need to fill in an answer grid. Directions for completing questions with answer grids are provided on the next page.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided. Only responses written within the provided space will be scored.

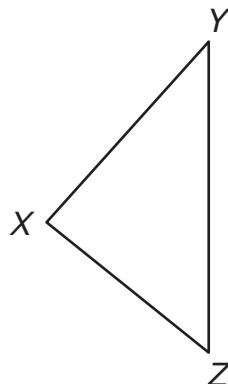
- 1 Albert drew the line represented by this equation on a coordinate plane.

$$y = -\frac{1}{2}x + 5$$

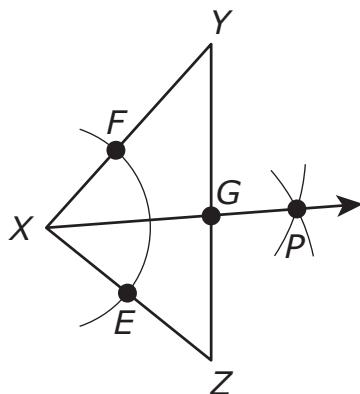
On the same coordinate plane, Penny drew a line that is perpendicular to Albert's line **and** passes through the point $(-4, 3)$. Which of the following equations represents Penny's line?

- (A) $y = 2x + 5$
- (B) $y = 2x + 11$
- (C) $y = -2x - 5$
- (D) $y = -2x - 11$

- 2 Consider $\triangle XYZ$.



A compass and a straightedge were used to perform a construction given $\triangle XYZ$. This diagram shows the completed construction.



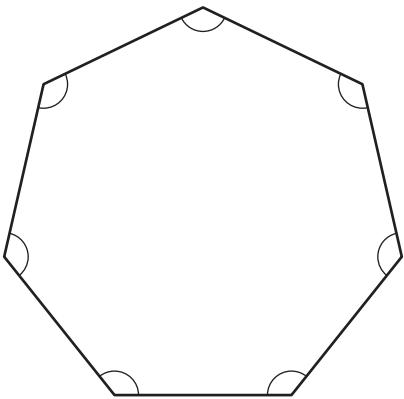
The following steps were used to complete the construction.

- An arc was drawn, with the compass, from point X through the sides of $\angle YXZ$ to create point F and point E.
- Two arcs were drawn, with the same compass setting, one from point F and one from point E. The arcs intersect to create point P.
- A ray was drawn, with the straightedge, from point X through point P.
- The intersection of \overrightarrow{XP} and \overline{YZ} was labeled point G.

Based on the construction, which of the following **must** be true?

- (A) \overline{XG} is congruent to \overline{YG} .
- (B) \overline{XG} is a median of $\triangle XYZ$.
- (C) \overline{XG} is an angle bisector of $\angle YXZ$.
- (D) \overline{XG} is a perpendicular bisector of \overline{YZ} .

- 3 Consider this polygon.



What is the sum, in degrees, of the measures of the interior angles of the polygon?

Enter your answer in the answer boxes at the top of the answer grid **and** completely fill the matching circles.

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2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

This question has four parts. Write your response in the answer space provided.

- 4 Consider this inequality.

$$y \geq 2x - 1$$

- A. On the coordinate plane provided in your answer space, graph the solution set of the inequality.
- B. Write an ordered pair that is a solution of the inequality from Part A. Show or explain how you got your answer.

Consider this system of inequalities.

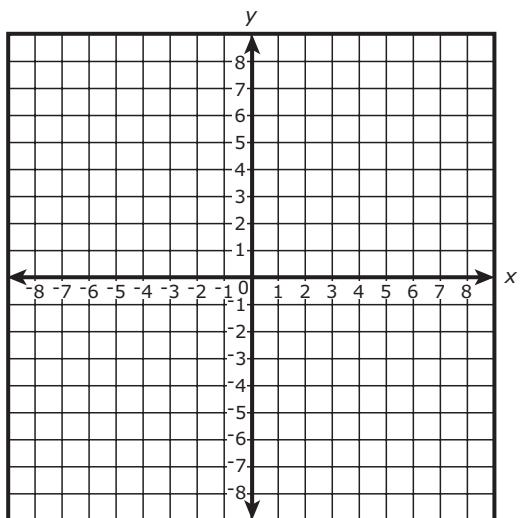
$$\begin{aligned}x + y &> -2 \\x - y &< 4\end{aligned}$$

- C. On the coordinate plane provided in your answer space, graph the solution set of the system of inequalities.
- D. Write an ordered pair that is a solution of both the inequality from Part A **and** the system of inequalities from Part C. Show or explain how you got your answer.

Write your answers on the next page.

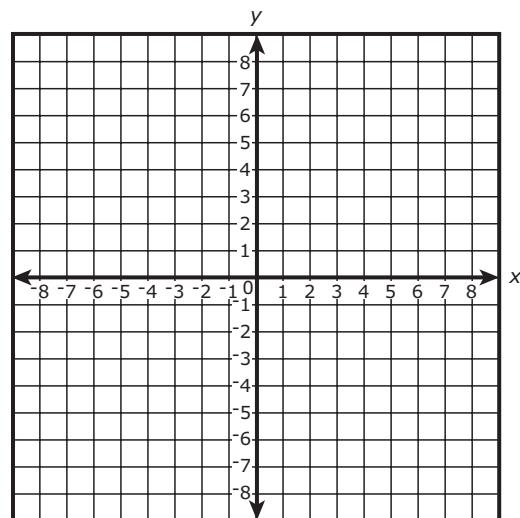
4

A.



B. _____

C.



D. _____

- 5 This equation represents the ideal gas law, where T is the temperature.

$$PV = nRT$$

Which equation has been correctly rearranged to solve for T ?

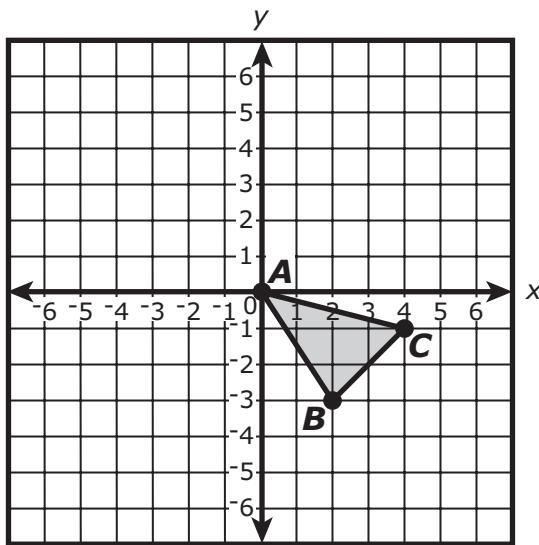
(A) $T = nR - PV$

(B) $T = PV - nR$

(C) $T = \frac{nR}{PV}$

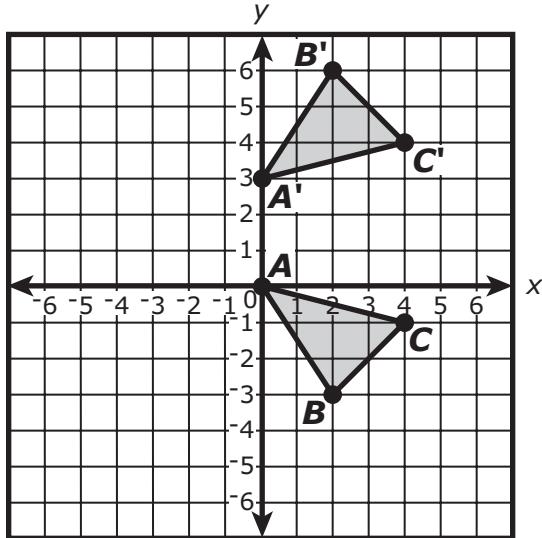
(D) $T = \frac{PV}{nR}$

- 6 Triangle ABC is shown on this coordinate plane.

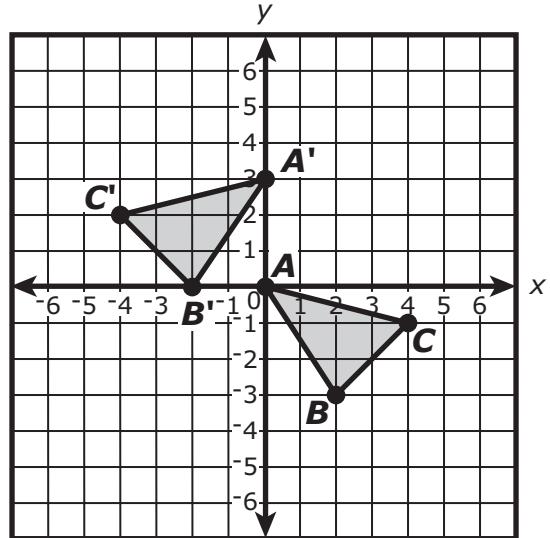


Triangle ABC will be reflected across the x -axis and then translated 3 units up to create its image, triangle $A'B'C'$. Which of the following shows the correct location of triangle $A'B'C'$ on the coordinate plane?

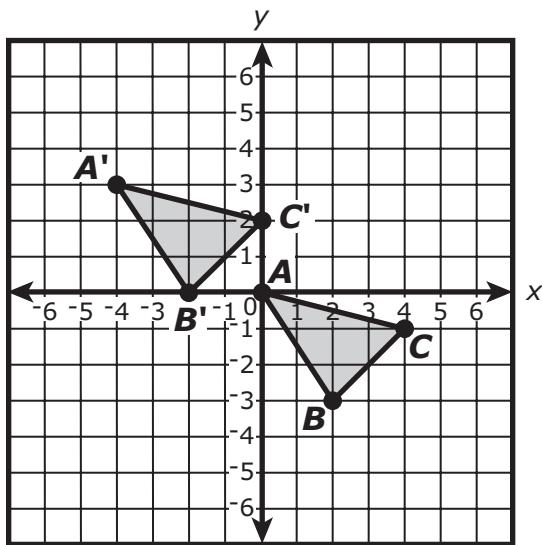
(A)



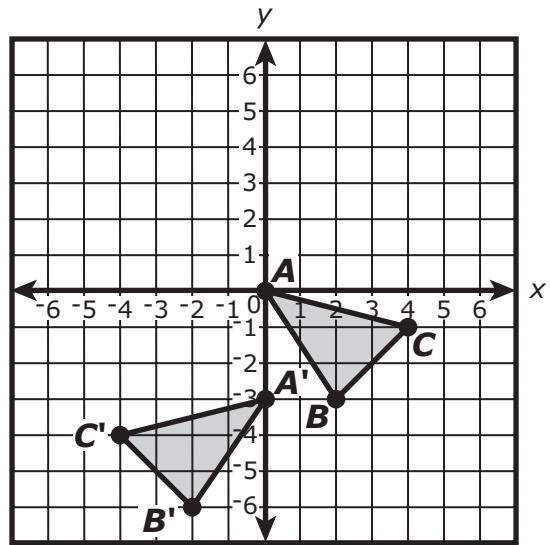
(B)



(C)



(D)



This question has two parts.

7 Part A

Which of the following expressions has a value that is rational?

(A) $3\sqrt{9} \cdot \sqrt{2}$

(B) $\frac{\sqrt{9}}{\pi}$

(C) $\frac{\pi\sqrt{24}}{\sqrt{6\pi^2}}$

(D) $-\sqrt{3} + 2$

Part B

Consider this expression.

$$1.8 + \sqrt{1.8}$$

Which of the following statements about the expression is true?

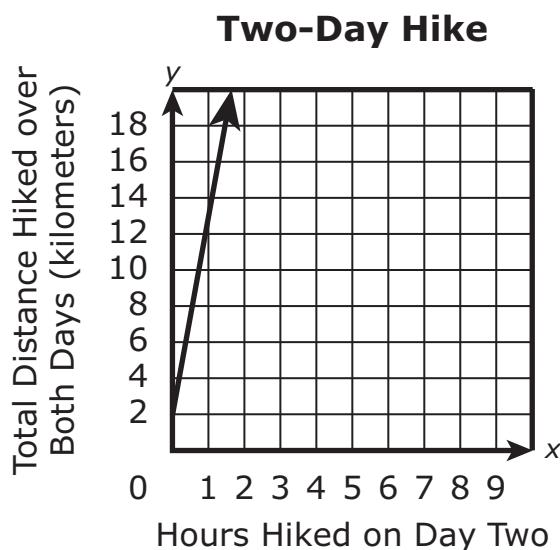
- (A) The expression is rational because one of the terms is rational.
- (B) The expression is irrational because one of the terms is irrational.
- (C) The expression is rational because both of the terms are rational.
- (D) The expression is irrational because both of the terms are irrational.

- 8 A student went on a two-day hike.

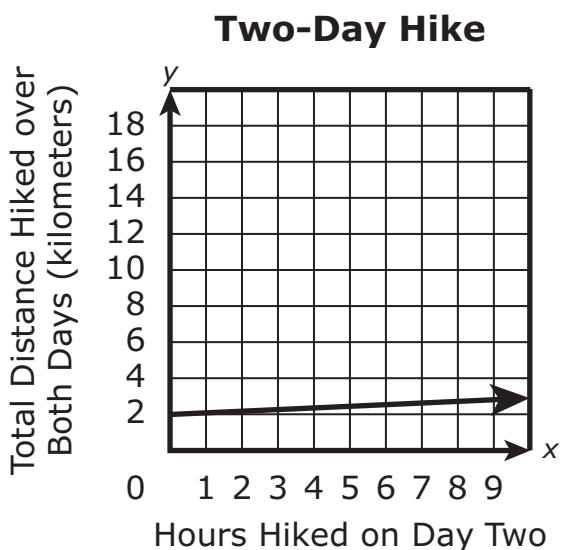
- On day one, the student hiked 11 kilometers.
- On day two, the student hiked at a rate of 2 kilometers per hour for x hours.

Which of the following graphs represents y , the total distance, in kilometers, the student hiked over both days after hiking for x hours on day two?

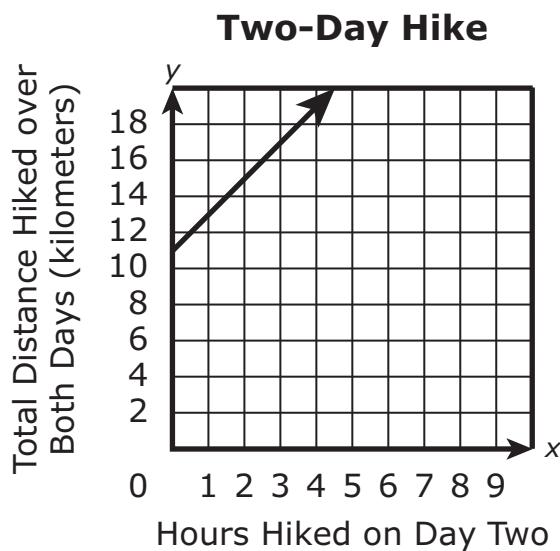
(A)



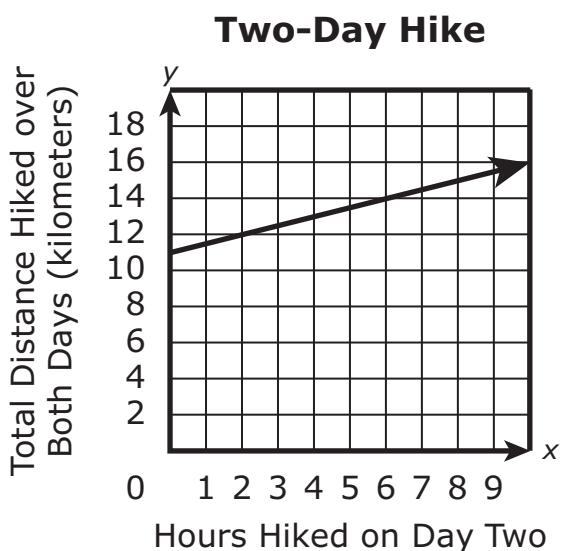
(B)



(C)



(D)



- 9 Consider this expression.

$$\sqrt[3]{t}$$

Which of the following are equivalent to the expression for all positive values of t ?

Select the **three** equivalent expressions.

(A) $t^{\frac{1}{3}}$

(B) $t^{\frac{2}{3}}$

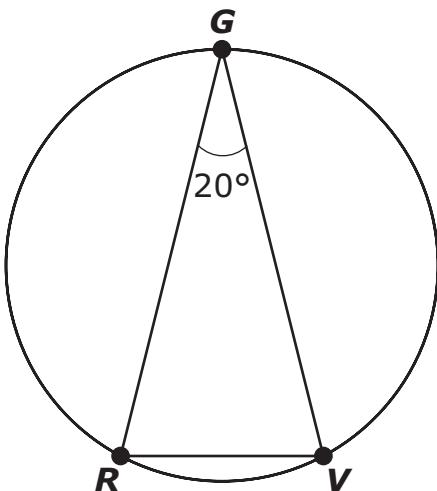
(C) $t^{\frac{3}{2}}$

(D) $\frac{t^{\frac{1}{3}}}{t^{\frac{2}{3}}}$

(E) $\frac{t^{\frac{2}{3}}}{t^{\frac{1}{3}}}$

(F) $\frac{t^{\frac{4}{3}}}{t}$

- 10 Triangle GRV is inscribed in a circle, as shown.



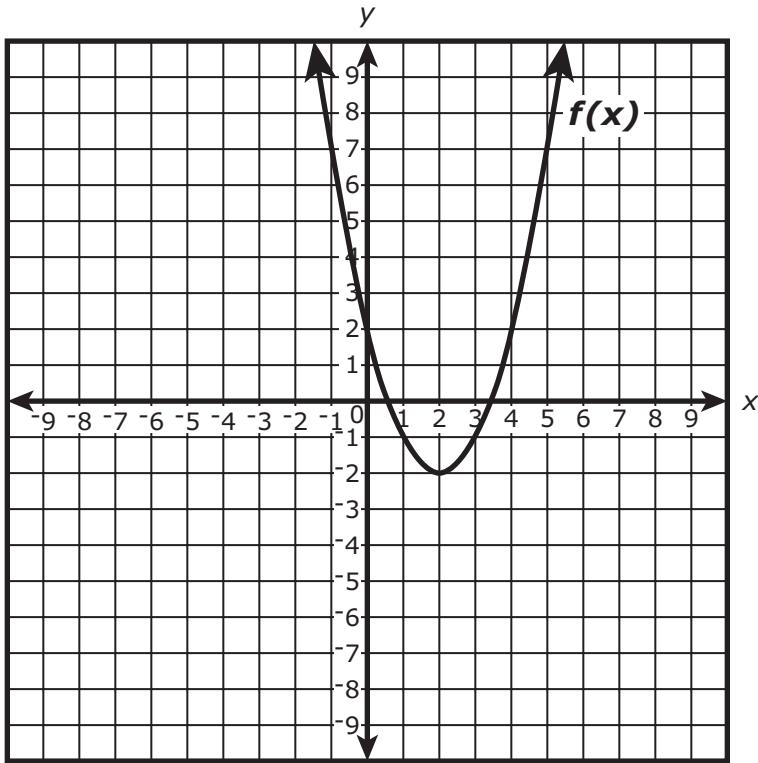
In the triangle, $\overline{GR} \cong \overline{GV}$. What is the measure, in degrees, of \widehat{GR} ?

Enter your answer in the answer boxes at the top of the answer grid **and** completely fill the matching circles.

(−)									
(•)	(•)	(•)	(•)	(•)	(•)	(•)	(•)	(•)	(•)
(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)
(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)	(1)
(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)	(2)
(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)	(3)
(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)	(4)
(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)	(5)
(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)	(6)
(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)	(7)
(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)	(8)
(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)

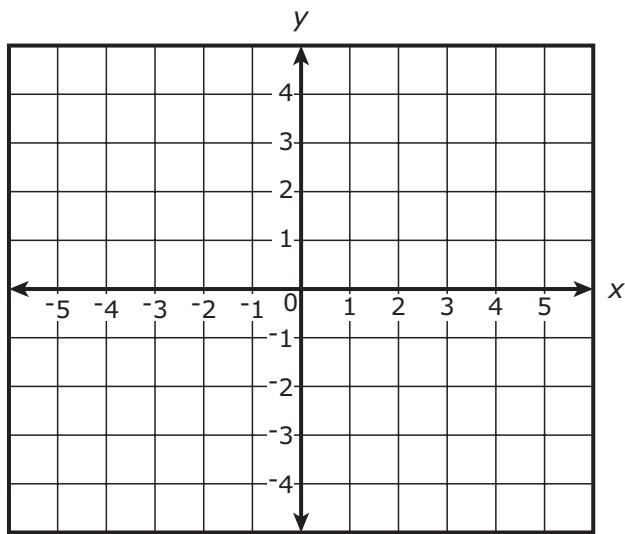
This question has four parts. Be sure to label each part of your response.

- 11 The function $f(x)$ is graphed on this coordinate plane.



- A. Based on the graph, what is the value of $f(4)$?
- B. If the value of $f(4) + k$ is -5 , what is the value of k ? Show or explain how you got your answer.
- C. Explain the difference between the graph of $f(x) + 3$ and the graph of $f(x + 3)$.
- D. On the coordinate plane provided in your answer space, use the graph of $f(x)$ to graph $-f(x + 2) + 1$.

11

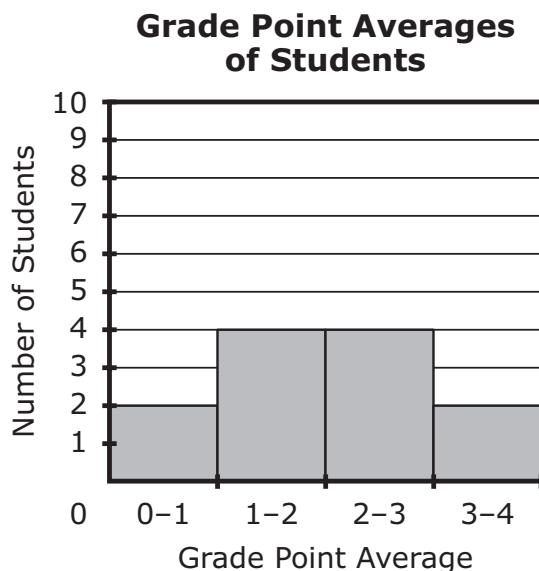


- 12 A guidance counselor will meet with twelve students to discuss their grade point averages. The list of grade point averages is shown.

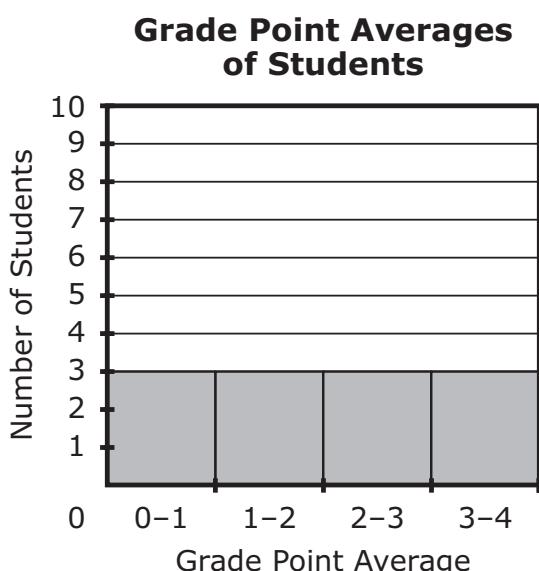
3.4, 2.2, 1.9, 3.8, 2.7, 3.1, 3.6, 1.8, 3.3, 2.4, 3.5, 2.9

Which of the following histograms correctly shows the distribution of the students' grade point averages?

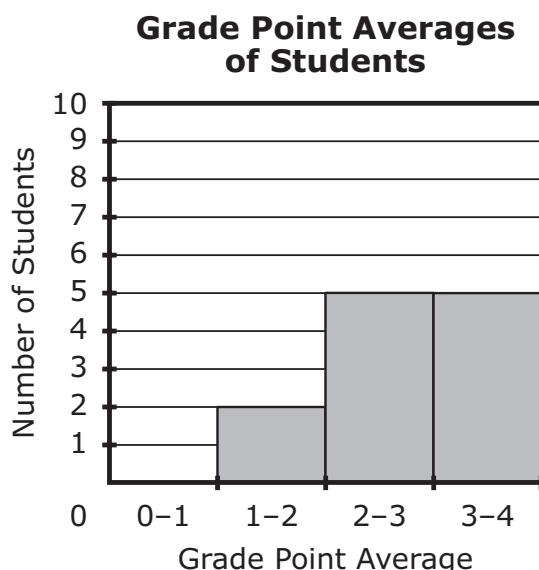
(A)



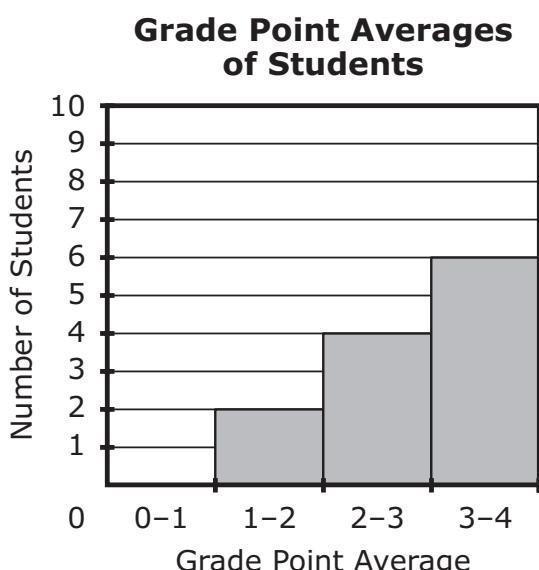
(B)



(C)



(D)



- 13 Ten years ago, the population of a town was 5,085 people. Since then, the population of the town has increased by a total of 19.51%.

Which of the following is **closest** to the current population of the town?

- (A) 5,500
- (B) 6,000
- (C) 6,600
- (D) 7,200



Grade 10 Mathematics

SESSION 2

This session contains 13 questions.

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Directions

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- 14 The number of loaves of bread remaining in a restaurant h hours after opening for the day can be modeled by this function.

$$L(h) = 42 - 3.5h$$

What is the domain of the function?

- (A) $0 \leq h \leq 12$
- (B) $0 \leq h \leq 38.5$
- (C) $0 \leq h \leq 42$
- (D) $0 \leq h \leq 45.5$

- 15 A series of transformations will be performed on a figure that is graphed on a coordinate plane. Which of the following series of transformations would produce a congruent figure?

Select the **three** correct answers.

- (A) a translation $\frac{1}{2}$ unit up followed by a reflection across the y -axis
- (B) a reflection across the x -axis followed by a rotation of 90 degrees
- (C) a dilation by a scale factor of 2 followed by a translation 5 units left
- (D) a dilation by a scale factor of -1 followed by a reflection across the y -axis
- (E) a dilation by a scale factor of -2 followed by a dilation by a scale factor of 2

- 16 A carpenter measured the dimensions of the floor in a rectangular room. He rounded the measurements to the nearest foot and recorded them as shown.

width = 9 feet

length = 15 feet

Based on the rounded measurements, which of the following statements could be true?

- (A) The actual width of the floor is 8 feet 4 inches.
- (B) The actual length of the floor is 15 feet 5 inches.
- (C) The actual area of the floor is 149.5 square feet.
- (D) The actual perimeter of the floor is 44 feet 10 inches.

This question has four parts. Be sure to label each part of your response.

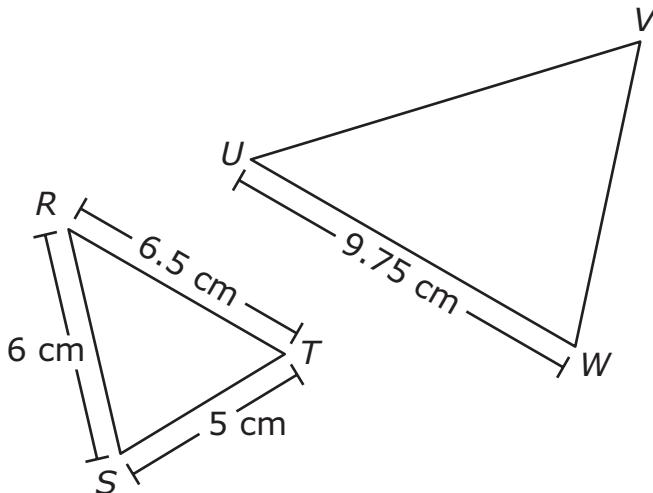
- 17 A coach recorded the number of goals scored by a soccer team in each of its last ten games. The data are shown.

3, 2, 10, 2, 1, 5, 3, 2, 1, 5

- A. What are the first quartile, the median, and the third quartile of the data? Be sure to label each one.
- B. What is the interquartile range of the data? Show or explain how you got your answer.
- C. The value 10 in the data is an outlier. Explain how this outlier affects the distribution of the data.
- D. If the value 10 in the data is replaced by the mode, by how much will the mean change? Show or explain how you got your answer.

17

- 18 Similar triangles RST and UVW are shown in this diagram.



Based on the dimensions in the diagram, what is the length, in centimeters, of \overline{VW} ?

Enter your answer in the answer boxes at the top of the answer grid **and** completely fill the matching circles.

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- 19 Consider this function.

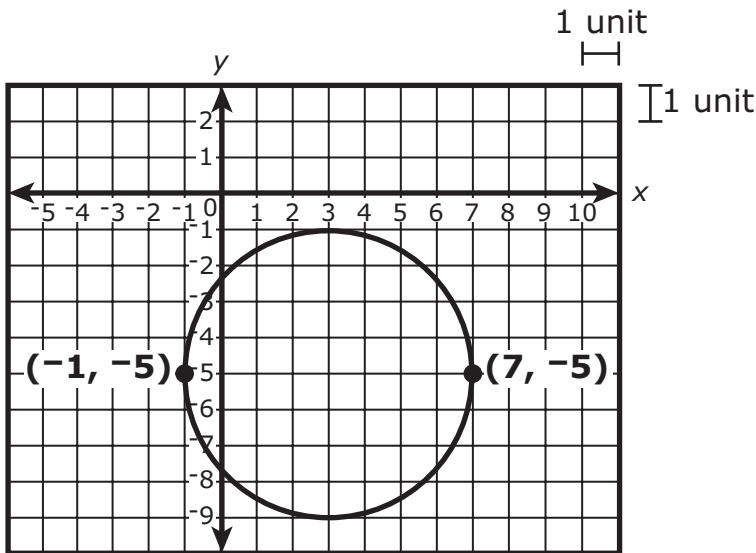
$$f(x) = x^2 + 1$$

Which of the following expressions is equivalent to $f(m + 2)$?

- (A) $m^2 + 3$
- (B) $m^2 + 5$
- (C) $m^2 + 4m + 4$
- (D) $m^2 + 4m + 5$

This question has two parts.

- 20 A circle is graphed on this coordinate plane.



Part A

What is the radius, in units, of the circle?

Enter your answer in the answer boxes at the top of the answer grid **and** completely fill the matching circles.

()								
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2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9

Part B

Which of the following equations represents the circle?

- (A) $(x + 3)^2 + (y - 5)^2 = 4$
- (B) $(x + 3)^2 + (y - 5)^2 = 8$
- (C) $(x - 3)^2 + (y + 5)^2 = 16$
- (D) $(x - 3)^2 + (y + 5)^2 = 64$

- 21 The number of customers doing business with a landscaping company each week, over t weeks since the beginning of last summer, can be modeled by this function.

$$f(t) = 21 + 4t$$

Based on the function, which of the following statements is true?

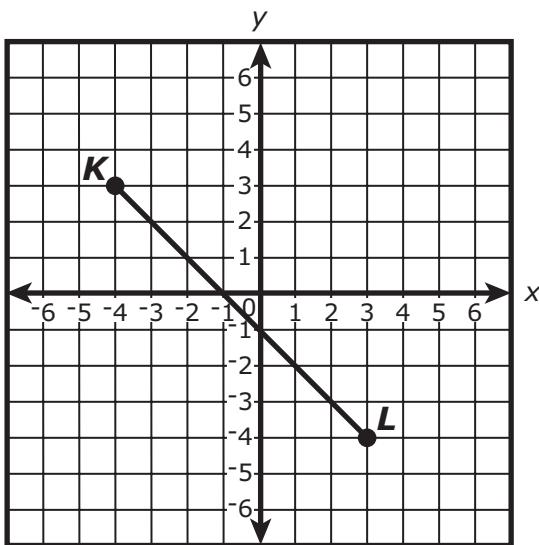
- (A) The number of customers increased by 21 per week.
- (B) The number of customers decreased by a factor of 4.
- (C) The company began last summer with 21 customers.
- (D) The company had a total of 21 customers after 4 weeks.

- 22 A student plotted \overline{EF} on a coordinate plane. The coordinates of the endpoints are shown.

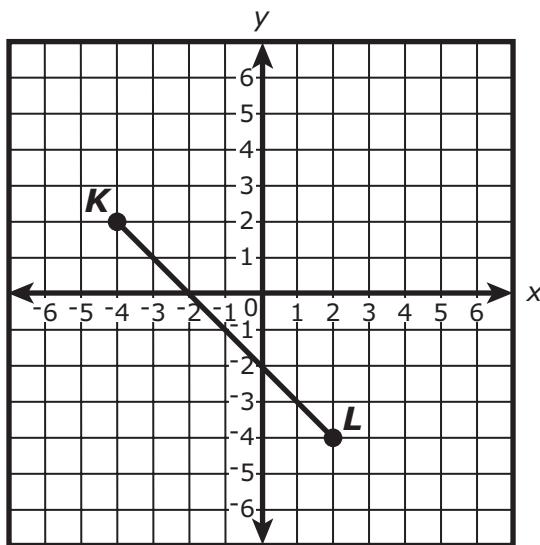
- $E(-2, 1)$
- $F(1, -2)$

The student will dilate \overline{EF} by a scale factor of 2 with respect to point F to create \overline{KL} . Which of the following graphs correctly shows \overline{KL} ?

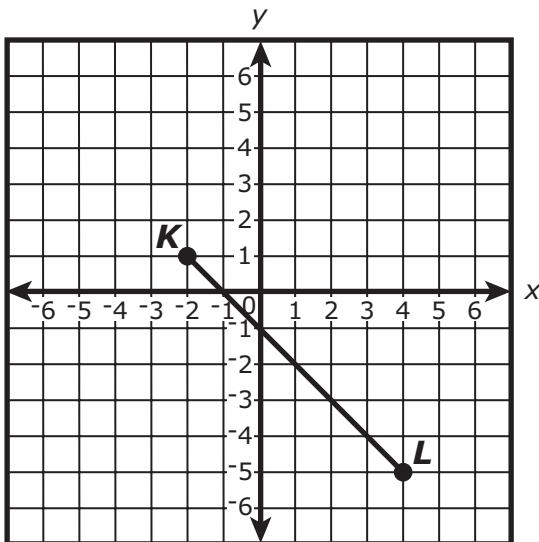
(A)



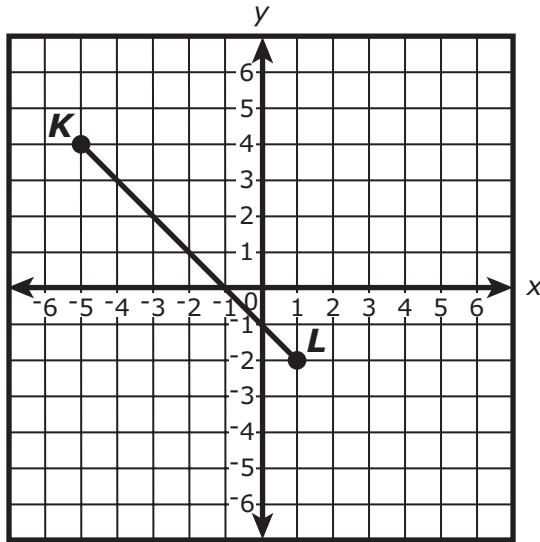
(B)



(C)



(D)



- 23 Consider these probabilities of events X and Y.

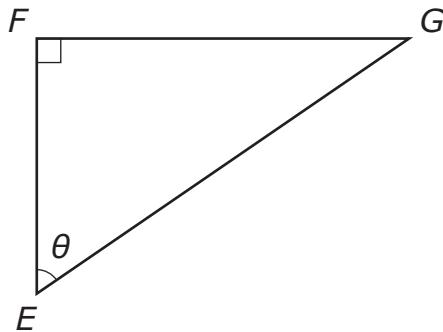
- $P(X) = 0.4$
- $P(Y) = 0.6$
- $P(X \text{ and } Y) = 0.24$
- $P(X \text{ or } Y) = 0.76$

Which of the following statements about events X and Y is true?

- (A) Events X and Y are dependent events because the equation $0.4 + 0.6 = 1$ is true.
- (B) Events X and Y are independent events because the equation $(0.4)(0.6) = 0.24$ is true.
- (C) Events X and Y are dependent events because the equation $P(X \text{ or } Y) = P(X \text{ and } Y)$ is not true.
- (D) Events X and Y are independent events because the equation $P(X \text{ and } Y) = P(X) + P(Y)$ is not true.

This question has four parts. Be sure to label each part of your response.

- 24 Consider right triangle EFG .



- A. What is $\sin(\theta)$ in terms of the sides of triangle EFG ? Write your response in the answer space provided.
- (A) $\frac{EF}{EG}$
(B) $\frac{FG}{EG}$
(C) $\frac{EG}{FG}$
(D) $\frac{FG}{EF}$
- B. Explain the relationship between $\sin(\theta)$ and $\cos(\angle G)$.
- C. If $\sin(30^\circ) = \frac{1}{2}$ and $\cos(\theta) = \frac{1}{2}$, what is the value of θ , in degrees? Show or explain how you got your answer.
- D. Consider this incomplete equation.

$$\cos(\angle G) = \cos(\square)$$

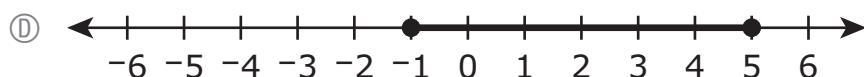
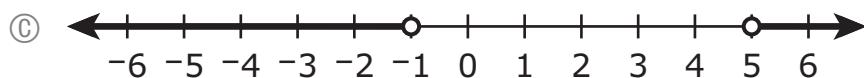
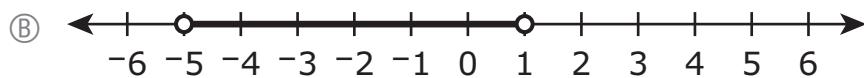
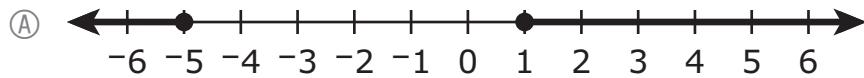
Complete the equation so that it represents $\cos(\angle G)$ in terms of θ .

24

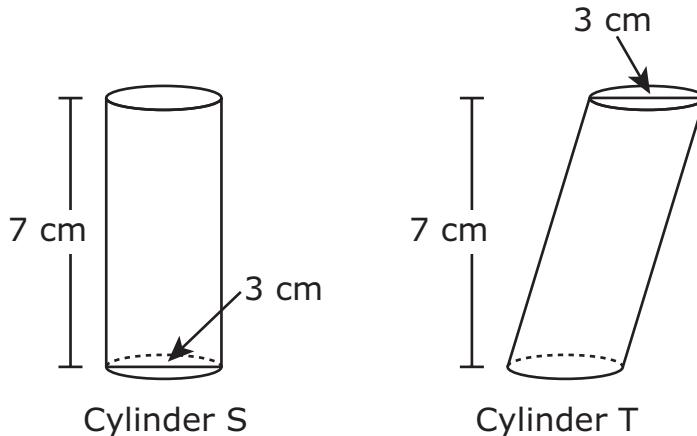
- 25 Consider this inequality.

$$|4 - 2x| > 6$$

Which of the following number lines shows the solution set of the inequality?



- 26 Right circular cylinder S, oblique circular cylinder T, and some of their dimensions are shown in this diagram.



Which statement about the cylinders is true?

- (A) The volume of cylinder S is equal to the volume of cylinder T.
- (B) The volume of cylinder S is less than the volume of cylinder T.
- (C) The volume of cylinder S is greater than the volume of cylinder T.
- (D) There is not enough information to compare the volumes of the cylinders.

Grade 10 Paper-Based Practice Test Answer Key

In April 2018, grade 10 students participated in a field test of the next-generation MCAS Mathematics assessment, which included new question types that align to the standards (<http://www.doe.mass.edu/mcas/tdd/math.html?section=nextgen>) in the [2017 Massachusetts Mathematics Curriculum Framework](#). This practice test is made up of questions from the field test. The purpose of the practice test is to increase students' familiarity with the new question types and to show examples of how the new content based on the grades 9 and 10 standards will be assessed on the operational test. The practice test has a much larger percentage of technology-enhanced questions than the operational test will have, and has a large percentage of content that was not previously assessed on the legacy MCAS. The practice test should not be used to evaluate how students will do on the next-generation operational test. The test design for the grade 10 operational test can be found [here](#).

The following pages include the answer key for all machine-scored items, followed by rubrics for the hand-scored items. The rubrics also show sample student responses; other valid methods for solving a problem can earn full credit unless a specific method is required by the item. In items where the scores are awarded for full and partial credit, students can still earn points for reasoning or modeling even if they make a computation error.

Session 1

Item Number	Item Type	Answer Key	Number of Points	Standard
1	SR	B	1	G.GPE.B.5
2	SR	C	1	G.CO.D.12
3	SA	900	1	G.CO.C.11
4	CR	<i>See Rubric on pages 2 and 3.</i>	4	A.REI.D.12
5	SR	D	1	A.CED.A.4
6	SR	A	1	G.CO.A.5
7	SR	Part A: C Part B: B	2	N.RN.B.3
8	SR	C	1	A.CED.A.2
9	SR	A, E, F	1	N.RN.A.1
10	SA	160	1	G.C.A.2
11	CR	<i>See Rubric on page 4.</i>	4	F.BF.B.3
12	SR	D	1	S.ID.A.1
13	SR	B	1	N.Q.A.2

Session 2

Item Number	Item Type	Answer Key	Number of Points	Standard
14	SR	A	1	F.IF.B.5
15	SR	A, B, D	1	G.CO.B.6
16	SR	B	1	N.Q.A.3
17	CR	<i>See Rubric on page 5.</i>	4	S.ID.A.3
18	SA	7.5	1	G.SRT.B.5
19	SR	D	1	F.IF.A.1
20	SA	Part A: 4 Part B: C	2	G.GPE.A.1

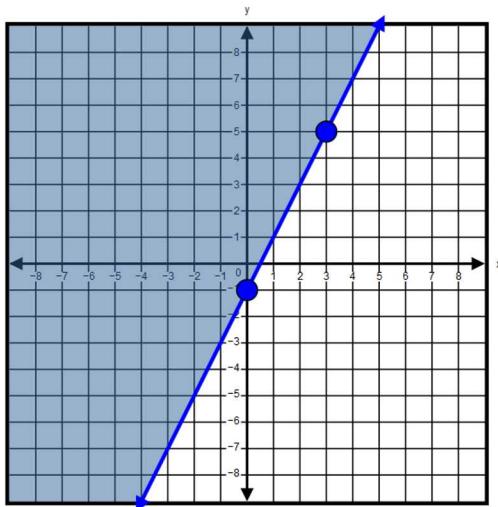
21	SR	C	1	F.LE.B.5
22	SR	D	1	G.SRT.A.1
23	SR	B	1	S.CP.A.2
24	CR	<i>See Rubric on page 6</i>	4	G.SRT.C.7
25	SR	C	1	A.REI.B.3
26	SR	A	1	G.GMD.A.1

Scoring Guide:

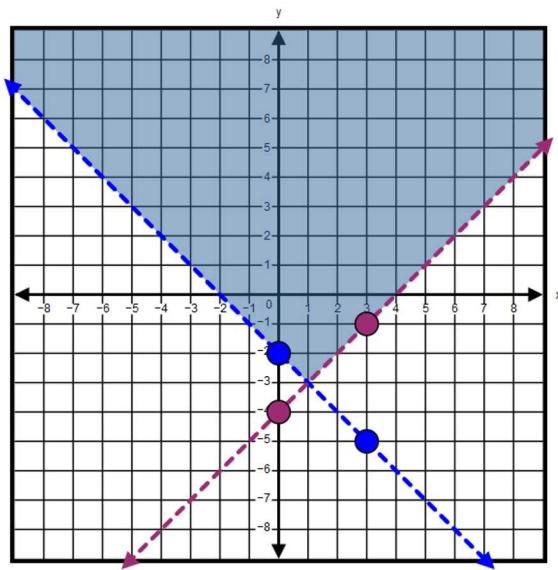
Score	Description
4	The student response demonstrates an exemplary understanding of the Algebra concepts involved in representing and solving inequalities graphically. The student correctly graphs an inequality and a system of inequalities, and identifies ordered pairs that satisfy both.
3	The student response demonstrates a good understanding of the Algebra concepts involved in representing and solving inequalities graphically. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
2	The student response demonstrates a fair understanding of the Algebra concepts involved in representing and solving inequalities graphically. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Algebra concepts involved in representing and solving inequalities graphically.
0	The student response contains insufficient evidence of an understanding of the Algebra concepts involved in representing and solving inequalities graphically to merit any points.

Sample Response:

A:

B: $(-5, 0)$; This point is located in the shaded region of my graph.

C:



D: $(0,2)$; This point is located in the shaded regions of both graphs.

Scoring Rubric for Grade 10 Practice Test**Session 1, Item #11****Scoring Guide:**

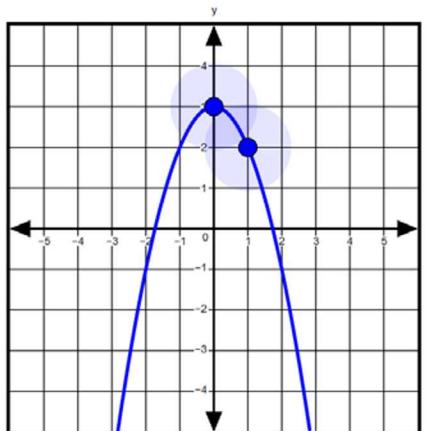
Score	Description
4	The student response demonstrates an exemplary understanding of the Functions concepts involved in building new functions from existing functions. The student correctly compares transformations of a function, and then graphs the function over a different transformation.
3	The student response demonstrates a good understanding of the Functions concepts involved in building new functions from existing functions. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
2	The student response demonstrates a fair understanding of the Functions concepts involved in building new functions from existing functions. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Functions concepts involved in building new functions from existing functions.
0	The student response contains insufficient evidence of an understanding of the Functions concepts involved in building new functions from existing functions to merit any points.

Sample Response:

A. 2

B. -7 ; Since $f(4) = 2$, then $2+k = -5$ and $k = -7$.C. $f(x)+3$ shifts $f(x)$ up 3 units, where $f(x+3)$ shifts $f(x)$ left 3 units.

D.



Scoring Rubric for Grade 10 Practice Test**Session 2, Item #17****Scoring Guide:**

Score	Description
4	The student response demonstrates an exemplary understanding of the Statistics and Probability concepts involved in summarizing, representing, and interpreting data on a single count or measurement variable. The student correctly analyzes a set of data and determines how an outlier and its removal affects the center and spread of the data..
3	The student response demonstrates a good understanding of the Statistics and Probability concepts involved in summarizing, representing, and interpreting data on a single count or measurement variable. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
2	The student response demonstrates a fair understanding of the Statistics and Probability concepts involved in summarizing, representing, and interpreting data on a single count or measurement variable. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Statistics and Probability concepts involved in summarizing, representing, and interpreting data on a single count or measurement variable.
0	The student response contains insufficient evidence of an understanding of the Statistics and Probability concepts involved in summarizing, representing, and interpreting data on a single count or measurement variable to merit any points.

Sample Response:

- A. first quartile score = 2; median score = 2.5; third quartile score = 5
- B. $3; 5 - 2 = 3$
- C. Because of this outlier, this data is skewed to the right.
- D. $0.8; 3.4 - 2.6 = 0.8$

Scoring Rubric for Grade 10 Practice Test**Session 2, Item #24****Scoring Guide:**

Score	Description
4	The student response demonstrates an exemplary understanding of the Geometry concepts involved in defining trigonometric ratios and solving problems involving right triangles. The student correctly describes the relationship between sine and cosine of complementary angles in a triangle.
3	The student response demonstrates a good understanding of the Geometry concepts involved in defining trigonometric ratios and solving problems involving right triangles. Although there is significant evidence that the student was able to recognize and apply the concepts involved, some aspect of the response is flawed. As a result, the response merits 3 points.
2	The student response demonstrates a fair understanding of the Geometry concepts involved in defining trigonometric ratios and solving problems involving right triangles. While some aspects of the task are completed correctly, others are not. The mixed evidence provided by the student merits 2 points.
1	The student response demonstrates a minimal understanding of the Geometry concepts involved in defining trigonometric ratios and solving problems involving right triangles.
0	The student response contains insufficient evidence of an understanding of the Geometry concepts involved in defining trigonometric ratios and solving problems involving right triangles to merit any points.

Sample Response:

A. B; $\frac{FG}{EG}$

B. They are equal; $\sin(\theta) = \frac{FG}{EG}$ and $\cos(\angle G) = \frac{FG}{EG}$ therefore they are equal.

C. 60° ; We have shown that $\sin(\theta) = \cos(90^\circ - \theta)$. In this case, $\theta = 30^\circ$, so $90^\circ - 30^\circ = 60^\circ$.

D. $\cos(\angle G) = \cos(90^\circ - \theta)$.