

2025 SAT Summer Class

Week 3

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SAT/DSAT/SSAT

Hans edu LLC (Columbia Academy)

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SCHOLASTIC APTITUDE TEST (SAT)

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Drill Problems: Week 3.1

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C O L U M B I A A C A D E M Y

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1. Function Evaluation (10 points)

The function g is defined by $g(x) = 6x$. For what value of x is $g(x) = 54$?

Answer:



2. Linear Function Definition (10 points)

In the xy -plane, the graph of the linear function f contains the points $(0, 3)$ and $(7, 31)$. Which equation defines f , where $y = f(x)$?

- (A) $f(x) = 28x + 34$
- (B) $f(x) = 3x + 38$
- (C) $f(x) = 4x + 3$
- (D) $f(x) = 7x + 3$

Answer:



3. Number Relationship (10 points)

The number y is 84 less than the number x . Which equation represents the relationship between x and y ?

- (A) $y = x + 84$
- (B) $y = \frac{1}{84}x$
- (C) $y = 84x$
- (D) $y = x - 84$

Answer:



4. Function Value (10 points)

The function f is defined by the equation $f(x) = 7x + 2$. What is the value of $f(x)$ when $x = 4$?

Answer:



5. Animal Weight Model (10 points)

A model predicts that a certain animal weighed 241 pounds when it was born and that the animal gained 3 pounds per day in its first year of life. This model is defined by an equation in the form $f(x) = a + bx$, where $f(x)$ is the predicted weight, in pounds, of the animal x days after it was born, and a and b are constants. What is the value of a ?

Answer:**6. Function Evaluation** (10 points)

The function g is defined by $g(x) = -x + 8$. What is the value of $g(0)$?

- (A) -8
- (B) 0
- (C) 4
- (D) 8

Answer:**7. Function Value** (10 points)

The function f is defined by $f(x) = 4x$. For what value of x does $f(x) = 8$?

Answer:

8. Cab Ride Cost (10 points)

The line graphed in the xy -plane below models the total cost, in dollars, for a cab ride, y , in a certain city during nonpeak hours based on the number of miles traveled, x .

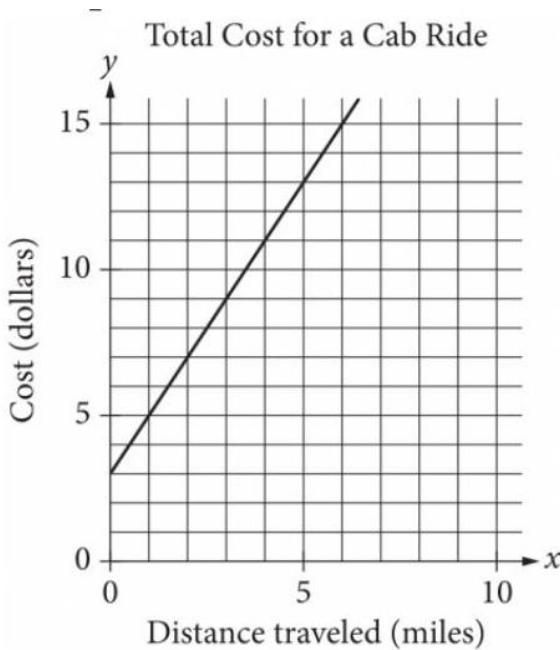


Figure 1: reference attached

According to the graph, what is the cost for each additional mile traveled, in dollars, of a cab ride?

- (A) \$2.00
- (B) \$2.60
- (C) \$3.00
- (D) \$5.00

Answer:



9. Cargo Movement (10 points)

A team of workers has been moving cargo off of a ship. The equation below models the approximate number of tons of cargo, y , that remains to be moved x hours after the team started working.

$$y = 120 - 25x$$

The graph of this equation in the xy -plane is a line. What is the best interpretation of the x -intercept in this context?

- (A) The team will have moved all the cargo in about 4.8 hours.
- (B) The team has been moving about 4.8 tons of cargo per hour.
- (C) The team has been moving about 25 tons of cargo per hour.
- (D) The team started with 120 tons of cargo to move.

Answer:





10. **Temperature Conversion** (10 points)

$$F(x) = \frac{9}{5}(x - 273.15) + 32$$

The function F gives the temperature, in degrees Fahrenheit, that corresponds to a temperature of x kelvins. If a temperature increased by 9.10 kelvins, by how much did the temperature increase, in degrees Fahrenheit?

- (A) 16.38
- (B) 48.38
- (C) 475.29
- (D) 507.29

Answer:



11. **Triangle Perimeter** (10 points)

The perimeter of an isosceles triangle is 83 inches. Each of the two congruent sides of the triangle has a length of 24 inches. What is the length, in inches, of the third side?

Answer:



12. **Equation Solution** (10 points)

$$(b - 2)x = 8$$

In the given equation, b is a constant. If the equation has no solution, what is the value of b ?

- (A) 2
- (B) 4
- (C) 6
- (D) 10

Answer:



13. **Equation Solutions** (10 points)

How many solutions does the equation $10(15x - 9) = -15(6 - 10x)$ have?

- (A) Exactly one
- (B) Exactly two
- (C) Infinitely many
- (D) Zero

Answer:



14. **Equation Value** (10 points)

$$\frac{4x}{5} = 20$$

In the equation above, what is the value of x ?

- (A) 25
- (B) 24
- (C) 16
- (D) 15

Answer:

15. **No Solution Equation** (10 points)

$$3(kx + 13) = \frac{48}{17}x + 36$$

In the given equation, k is a constant. The equation has no solution. What is the value of k ?

Answer:

16. **Equivalent Equation** (10 points)

Which of the following is equivalent to $4x + 6 = 12$?

- (A) $2x + 4 = 6$
- (B) $x + 3 = 3$
- (C) $3x + 2 = 4$
- (D) $2x + 3 = 6$

Answer:

17. **Cost Calculation** (10 points)

One pound of grapes costs \$2. At this rate, how many dollars will c pounds of grapes cost?

- (A) $2c$
- (B) $2 + c$
- (C) $\frac{2}{c}$
- (D) $\frac{c}{2}$

Answer:



18. Flag Count (10 points)

A principal used a total of 25 flags that were either blue or yellow for field day. The principal used 20 blue flags. How many yellow flags were used?

- (A) 5
- (B) 20
- (C) 25
- (D) 30

Answer:**19. Equation Solution (10 points)**

$$8x = 88$$

What value of x is the solution to the given equation?

- (A) 11
- (B) 80
- (C) 96
- (D) 704

Answer:**20. Profit Calculation (10 points)**

A certain product costs a company \$65 to make. The product is sold by a salesperson who earns a commission that is equal to 20% of the sales price of the product. The profit the company makes for each unit is equal to the sales price minus the combined cost of making the product and the commission. If the sales price of the product is \$100, which of the following equations gives the number of units, u , of the product the company sold to make a profit of \$6,840?

- (A) $(100(1 - 0.2) - 65)u = 6,840$
- (B) $(100 - 65)(1 - 0.8)u = 6,840$
- (C) $0.8(100) - 65u = 6,840$
- (D) $(0.2(100) + 65)u = 6,840$

Answer:

21. Shipping Cost (10 points)

$$3a + 4b = 25$$

A shipping company charged a customer \$25 to ship some small boxes and some large boxes. The equation above represents the relationship between a , the number of small boxes, and b , the number of large boxes, the customer had shipped. If the customer had 3 small boxes shipped, how many large boxes were shipped?

- (A) 3
- (B) 4
- (C) 5
- (D) 6

Answer:**22. Parallel Line** (10 points)

What is the equation of the line that passes through the point $(0, 5)$ and is parallel to the graph of $y = 7x + 4$ in the xy plane?

- (A) $y = 5x$
- (B) $y = 7x + 5$
- (C) $y = 7x$
- (D) $y = 5x + 7$

Answer:**23. Time Relationship** (10 points)

$$x + y = 75$$

The equation above relates the number of minutes, x , Maria spends running each day and the number of minutes, y , she spends biking each day. In the equation, what does the number 75 represent?

- (A) The number of minutes spent running each day
- (B) The number of minutes spent biking each day
- (C) The total number of minutes spent running and biking each day
- (D) The number of minutes spent biking for each minute spent running

Answer:

24. Line Equation (10 points)

Line t in the xy -plane has a slope of $-\frac{1}{3}$ and passes through the point $(9, 10)$. Which equation defines line t ?

- (A) $y = 13x - \frac{1}{3}$
- (B) $y = 9x + 10$
- (C) $y = -\frac{x}{3} + 10$
- (D) $y = -\frac{x}{3} + 13$

Answer:

**25. Box Production** (10 points)

A machine makes large boxes or small boxes, one at a time, for a total of 700 minutes each day. It takes the machine 10 minutes to make a large box or 5 minutes to make a small box. Which equation represents the possible number of large boxes, x , and small boxes, y , the machine can make each day?

- (A) $5x + 10y = 700$
- (B) $10x + 5y = 700$
- (C) $(x + y)(10 + 5) = 700$
- (D) $(10 + x)(5 + y) = 700$

Answer:

**26. Polygon Construction** (10 points)

A total of 364 paper straws of equal length were used to construct two types of polygons: triangles and rectangles. The triangles and rectangles were constructed so that no two polygons had a common side. The equation $3x + 4y = 364$ represents this situation, where x is the number of triangles constructed and y is the number of rectangles constructed. What is the best interpretation of $(x, y) = (24, 73)$ in this context?

- (A) If 24 triangles were constructed, then 73 rectangles were constructed.
- (B) If 24 triangles were constructed, then 73 paper straws were used.
- (C) If 73 triangles were constructed, then 24 rectangles were constructed.
- (D) If 73 triangles were constructed, then 24 paper straws were used.

Answer:



27. Music Practice (10 points)

The equation $y = 0.1x$ models the relationship between the number of different pieces of music a certain pianist practices, y , during an x -minute practice session. How many pieces did the pianist practice if the session lasted 30 minutes?

- (A) 1
- (B) 3
- (C) 10
- (D) 30

Answer:**28. Line Intersection** (10 points)

In the xy -plane, line k intersects the y -axis at the point $(0, -6)$ and passes through the point $(2, 2)$. If the point $(20, w)$ lies on line k , what is the value of w ?

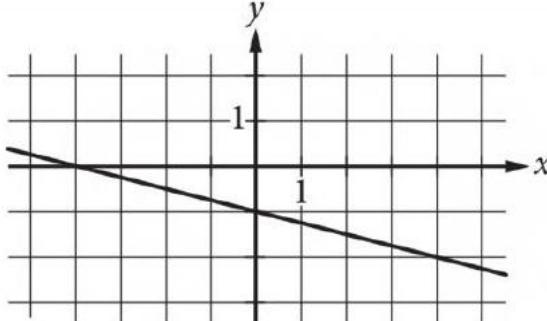
Answer:**29. Graph Equation** (10 points)

Figure 2: reference attached

Which of the following is an equation of the graph shown in the xy -plane above?

- (A) $y = -\frac{1}{4}x - 1$
- (B) $y = -x - 4$
- (C) $y = -x - \frac{1}{4}$
- (D) $y = -4x - 1$

Answer:

30. Food Preparation (10 points)

An employee at a restaurant prepares sandwiches and salads. It takes the employee 1.5 minutes to prepare a sandwich and 1.9 minutes to prepare a salad. The employee spends a total of 46.1 minutes preparing x sandwiches and y salads. Which equation represents this situation?

- (A) $1.9x + 1.5y = 46.1$
- (B) $1.5x + 1.9y = 46.1$
- (C) $x + y = 46.1$
- (D) $30.7x + 24.3y = 46.1$

Answer:**31. Transit Pass (10 points)**

A local transit company sells a monthly pass for \$95 that allows an unlimited number of trips of any length. What is the minimum number of trips per month for which a monthly pass could cost less than purchasing individual tickets for trips? Individual Tickets trips cost \$1.50, \$2.50, or \$3.50, depending on the length of the trip.

Answer:**32. Cookie Count (10 points)**

A bakery sells trays of cookies. Each tray contains at least 50 cookies but no more than 60. Which of the following could be the total number of cookies on 4 trays of cookies?

- (A) 165
- (B) 205
- (C) 245
- (D) 285

Answer:



33. Inequality System (10 points)

$$\begin{aligned}y &\leq x + 7 \\y &\geq -2x - 1\end{aligned}$$

Which point (x, y) is a solution to the given system of inequalities in the xy -plane?

- (A) $(-14, 0)$
- (B) $(0, -14)$
- (C) $(0, 14)$
- (D) $(14, 0)$

Answer:



34. Sales Commission (10 points)

A salesperson's total earnings consist of a base salary of x dollars per year, plus commission earnings of 11% of the total sales the salesperson makes during the year. This year, the salesperson has a goal for the total earnings to be at least 3 times and at most 4 times the base salary. Which of the following inequalities represents all possible values of total sales s , in dollars, the salesperson can make this year in order to meet that goal?

- (A) $2x \leq s \leq 3x$
- (B) $\frac{2}{0.11}x \leq s \leq \frac{3}{0.11}x$
- (C) $3x \leq s \leq 4x$
- (D) $\frac{3}{0.11}x \leq s \leq \frac{4}{0.11}x$

Answer:



35. Walking Goal (10 points)

Ty set a goal to walk at least 24 kilometers every day to prepare for a multiday hike. On a certain day, Ty plans to walk at an average speed of 4 kilometers per hour. What is the minimum number of hours Ty must walk on that day to fulfill the daily goal?

- (A) 4
- (B) 6
- (C) 20
- (D) 24

Answer:



36. Number Relationship (10 points)

A number x is at most 2 less than 3 times the value of y . If the value of y is -4, what is the greatest possible value of x ?

Answer:**37. Exam Score** (10 points)

Tom scored 85, 78, and 98 on his first three exams in history class. Solving which inequality gives the score, G , on Tom's fourth exam that will result in a mean score on all four exams of at least 90?

- (A) $90 - (85 + 78 + 98) \leq 4G$
- (B) $4G + 85 + 78 + 98 \geq 360$
- (C) $\frac{(G+85+78+98)}{4} \geq 90$
- (D) $\frac{(85+78+98)}{4} \geq 90 - 4G$

Answer:**38. Inequality Solution** (10 points)

$$y < -4x + 4$$

Which point (x, y) is a solution to the given inequality in the xy -plane?

- (A) $(-4, 0)$
- (B) $(0, 5)$
- (C) $(2, 1)$
- (D) $(2, -1)$

Answer:

39. Elephant Weight (10 points)

A certain elephant weighs 200 pounds at birth and gains more than 2 but less than 3 pounds per day during its first year. Which of the following inequalities represents all possible weights w , in pounds, for the elephant 365 days after birth?

- (A) $400 < w < 600$
- (B) $565 < w < 930$
- (C) $730 < w < 1,095$
- (D) $930 < w < 1,295$

Answer:**40. Heart Rate** (10 points)

$$H = 120p + 60$$

The Karvonen formula above shows the relationship between Alice's target heart rate H , in beats per minute (bpm), and the intensity level p of different activities. When $p = 0$, Alice has a resting heart rate. When $p = 1$, Alice has her maximum heart rate. It is recommended that p be between 0.5 and 0.85 for Alice when she trains. Which of the following inequalities describes Alice's target training heart rate?

- (A) $120 \leq H \leq 162$
- (B) $102 \leq H \leq 120$
- (C) $60 \leq H \leq 162$
- (D) $60 \leq H \leq 102$

Answer:

41. Ticket Sales (10 points)

A petting zoo sells two types of tickets. The standard ticket, for admission only, costs \$5. The premium ticket, which includes admission and food to give to the animals, costs \$12. One Saturday, the petting zoo sold a total of 250 tickets and collected a total of \$2,300 from ticket sales. Which of the following systems of equations can be used to find the number of standard tickets, s , and premium tickets, p , sold on that Saturday?

(A) $s + p = 250$
 $5s + 12p = 2,300$

(B) $s + p = 250$
 $12s + 5p = 2,300$

(C) $5s + 12p = 250$
 $s + p = 2,300$

(D) $12s + 5p = 250$
 $s + p = 2,300$

Answer:**42. System Solution (10 points)**

$$\begin{aligned}x + y &= 18 \\5y &= x\end{aligned}$$

What is the solution (x, y) to the given system of equations?

- (A) $(15, 3)$
(B) $(16, 2)$
(C) $(17, 1)$
(D) $(18, 0)$

Answer:

43. Line Intersection (10 points)

$$y = 2x + 10$$

$$y = 2x - 1$$

At how many points do the graphs of the given equations intersect in the xy -plane?

- (A) Zero
- (B) Exactly one
- (C) Exactly two
- (D) Infinitely many

Answer:



44. No Solution System (10 points)

$$4x - 6y = 10y + 2$$

$$ty = \frac{1}{2} + 2x$$

In the given system of equations, t is a constant. If the system has no solution, what is the value of t ?

Answer:

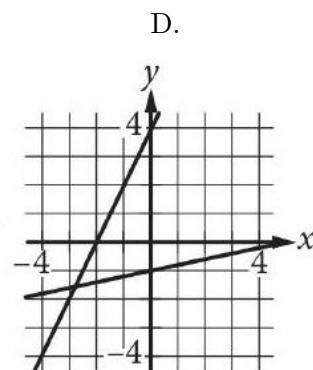
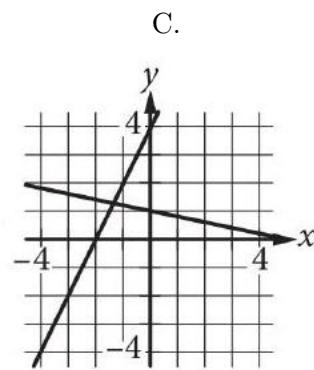
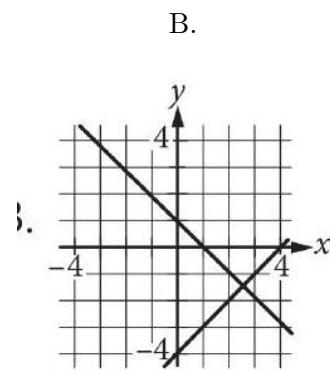
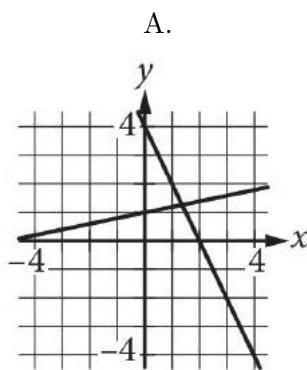


45. System Graph (10 points)

$$x + 5y = 5$$

$$2x - y = -4$$

Which of the following graphs in the xy -plane could be used to solve the system of equations above?



Answer:



46. System Value (10 points)

$$\begin{aligned}x &= 10 \\y &= x + 21\end{aligned}$$

The solution to the given system of equations is (x, y) . What is the value of y ?

- (A) 2.1
- (B) 10
- (C) 21
- (D) 31

Answer:

**47. System Solution** (10 points)

$$\begin{aligned}y &= -\frac{1}{9}x \\y &= \frac{1}{2}x\end{aligned}$$

The solution to the given system of equations is (x, y) . What is the value of x ?

- (A) -9
- (B) -7
- (C) 0
- (D) 2

Answer:



48. Bus Travel (10 points)

A bus traveled on the highway and on local roads to complete a trip of 160 miles. The trip took 4 hours. The bus traveled at an average speed of 55 miles per hour (mph) on the highway and an average speed of 25 mph on local roads. If x is the time, in hours, the bus traveled on the highway and y is the time, in hours, it traveled on local roads, which system of equations represents this situation?

(A) $55x + 25y = 4$
 $x + y = 160$

(B) $55x + 25y = 160$
 $x + y = 4$

(C) $25x + 55y = 4$
 $x + y = 160$

(D) $25x + 55y = 160$
 $x + y = 4$

Answer:**49. System Solution (10 points)**

$$y = 2x + 3$$

$$x = 1$$

What is the solution (x, y) to the given system of equations?

- (A) $(1, 2)$
(B) $(1, 5)$
(C) $(2, 3)$
(D) $(2, 7)$

Answer:

50. System Graph (10 points)

A system of two linear equations is graphed in the xy -plane below.

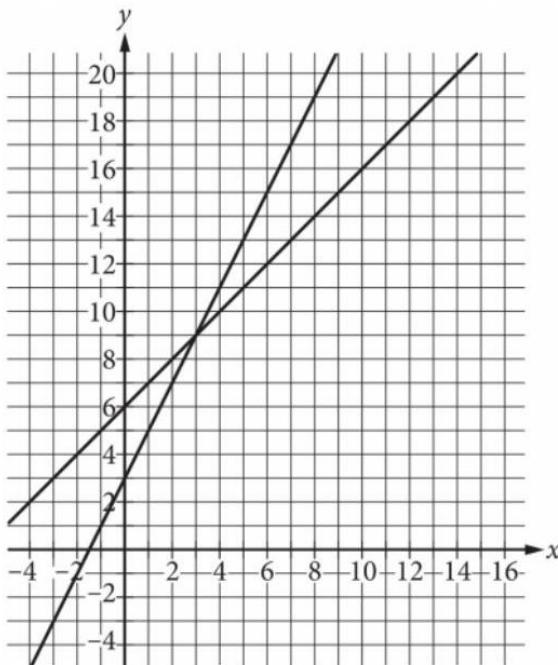


Figure 3: reference attached

Which of the following points is the solution to the system of equations?

- (A) (3, 9)
- (B) (6, 15)
- (C) (8, 10)
- (D) (12, 18)

Answer:



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**24. Which choice completes the text with the most logical transition?**

The study of electromagnetism in the field of physics has not only revolutionized technology but has also deepened our understanding of the natural world. Electromagnetic waves, such as radio waves, microwaves, and visible light, serve as the foundation for various applications, including communication, energy transmission, and our exploration of the universe through telescopes. _____, the knowledge of these waves has paved the way for the development of numerous devices and technologies that harness different segments of the electromagnetic spectrum.

- A) For example,
- B) In conclusion,
- C) As a result,
- D) In other words,

25. Which choice completes the text so that it conforms to the conventions of Standard English?

The human brain is a complex organ, and its functions are still not fully understood. However, neuroscientists have made significant progress in recent years, and ongoing research is shedding light on the intricacies of brain function. These discoveries are crucial for advancing our knowledge of neuroscience _____ treatments for neurological disorders.

- A) ; and developing
- B) and for developing
- C) , with developing
- D) - developing

Mathematics—Module 1

1. An apple falls from a high branch. The height of the apple is modeled by the function $f(x) = -x^2 - 2x + 7$, where $f(x)$ represents the height of the apple and x represents the number of seconds since the fall. After how many seconds will the apple reach the ground?

- A) 1.8
- B) 2.1
- C) 2.3
- D) 2.6

2. If $2x + 6 = -2$, what is the value of $10x + 11$?

- A) -4
- B) -8
- C) -29
- D) -51

3. Expand the following expression: $(x + 2)(x - 3)$

- A) $x^2 - 1$
- B) $x^2 - 6$
- C) $x^2 - x - 6$
- D) $x^2 - 5x - 1$

Refer to the following for question 4:

The table below represents the test scores on a chemistry final, as well as the lab grades for the semester.

Final Exam	78	85	91	77	94	83	87
Lab Grade	84	86	98	90	97	85	90

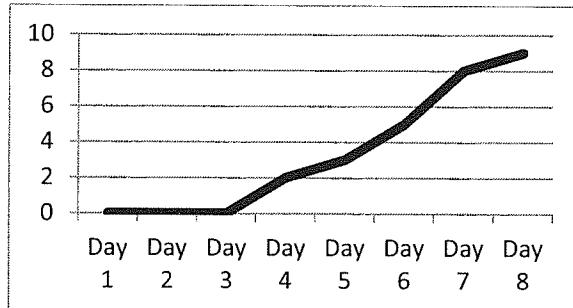
4. What is the difference of the mean and median of the lab grades?

- A) 0
- B) 1.5
- C) 3
- D) 4.5

5. The graph of $y = 2x^2 + 3x$ intersects the graph of $y = -x$ at $(0, 0)$ and (a, b) . What is the value of b ?

6. A population of bacteria tripled every day. After 5 days, there were 2,430 bacteria. How many were there originally?

Refer to the following for question 7:



Beth plants a number of sunflower seeds and checks daily to see if any have sprouted. The graph above shows how many seedlings are growing each day when she checks.

7. Which day did the first seedling appear?

- A) Day 1
- B) Day 2
- C) Day 3
- D) Day 4

8. Kasie is filling glasses with water. Each glass is cylindrical with a radius of 1.25 inches and a height of 6 inches. If she fills them to a height of 5 inches, how many glasses can she fill with 3 quarts of water (1 gallon = 231 cubic inches)? Use 3.14 for π .

- A) 3
- B) 5
- C) 7
- D) 9



9. Mandy can buy 4 containers of yogurt and 3 boxes of crackers for \$9.55. She can buy 2 containers of yogurt and 2 boxes of crackers for \$5.90. How much does one box of crackers cost?

- A) \$1.75
- B) \$2.00
- C) \$2.25
- D) \$2.50

10. A researcher surveyed 350 people at a grocery store, offering them a sample of a well-known juice along with a new brand of juice. 85% of those who tasted the two juices preferred the new brand. Which of the following inferences is a logical conclusion?

- A) 85% of shoppers will prefer the new brand of juice.
- B) 15% of shoppers will prefer the new brand of juice.
- C) Most shoppers will prefer the new brand of juice.
- D) Most shoppers will prefer the well-known juice.

11. If the solution for the system of equations below is (x, y) , what is the value of $x^2 - 3y$?

$$\begin{aligned}5x - 6y &= 12 \\-2x + 3y &= -5\end{aligned}$$

- A) -3
- B) -1
- C) 3
- D) 5

12. A colony of *Escherichia coli* is inoculated from a Petri dish into a test tube containing 50 mL of nutrient broth. The test tube is placed in a 37 °C incubator and agitator. After one hour, the number of bacteria in the test tube is determined to be 8×10^6 . Given that the doubling time of *Escherichia coli* is 20 minutes with agitation at 37 °C, approximately how many bacteria should the test tube contain after eight hours of growth?

- A) 2.56×10^8
- B) 2.05×10^9
- C) 1.7×10^{14}
- D) 1.7×10^{13}

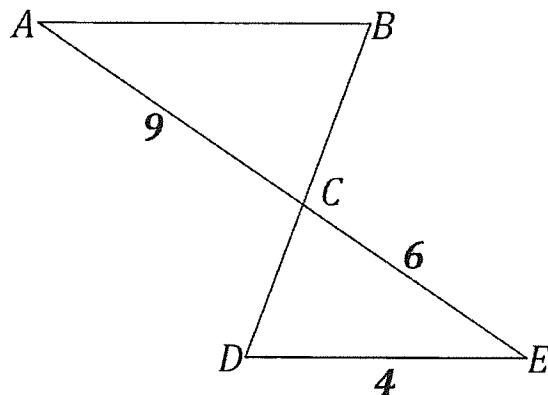
13. If $3x - 4 = -1$, what is the value of $12x + 3$?

- A) 18
- B) 15
- C) 6
- D) 1

14. Evaluate the expression $4\sqrt{6} + 8\sqrt{6}$. Simplify your answer as much as possible.

- A) $12\sqrt{12}$
- B) 72
- C) $12\sqrt{6}$
- D) $24\sqrt{3}$

15. In the figure below (not drawn to scale), $\triangle ABC$ is similar to $\triangle EDC$. What is the length of AB ?



16. The equation of a circle is shown below. What is the circle's diameter?

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

- A) 2
- B) 3
- C) 5
- D) 6

17. If $4a + 3 \leq 1$, what is the greatest possible value of $6a - 2$?

- A) -5
- B) -3
- C) $-\frac{1}{2}$
- D) 1

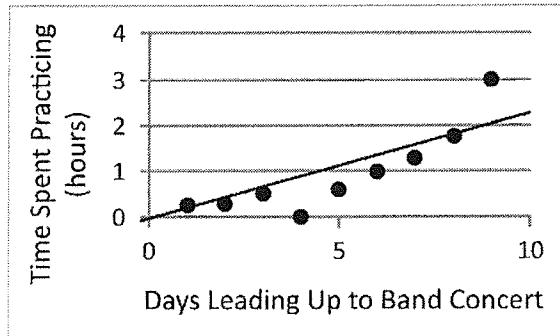
18. In the equations below, i refers to the amount of money (in dollars) invested in production of x products and p refers to the profits. What is the “break even” number of products, where investments are equal to profits?

$$i = 15,200 + 0.75x$$

$$p = 5.5x$$

- A) 2,432
- B) 3,075
- C) 3,200
- D) 17,600

19. The scatterplot below shows Julio's time (in hours) on the y -axis spent practicing his trumpet on the days (x -axis) leading up to a band concert. What is the difference in the amount of time he spent on the final day versus the amount predicted by the line of best fit?



- A) 0.5 hours
 B) 1 hour
 C) 2 hours
 D) 3 hours
20. The formula for finding the volume of a cone is $V = \frac{1}{3}\pi r^2 h$. Which of the following equations is correctly solved for r ?

- A) $r = \frac{1}{3}\pi h$
 B) $r = \sqrt{\frac{3V}{\pi h}}$
 C) $r = \frac{3V}{\pi h}$
 D) $r = V - \frac{1}{3}\pi h$

21. Jan has six pairs of socks for every pair of shoes she owns. If she has 12 pairs of shoes and s pairs of socks, which of the following equations is true?

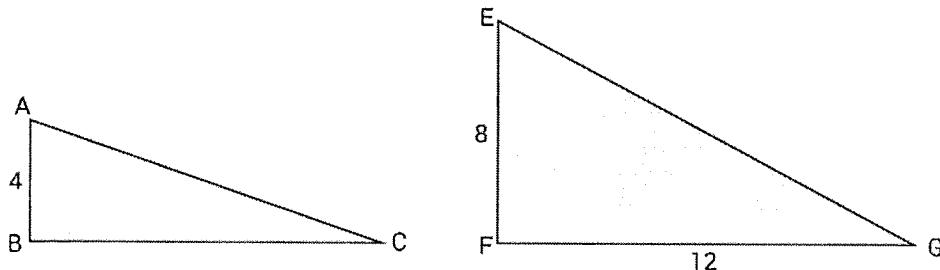
- A) $12s = 6$
 B) $6s = 12$
 C) $\frac{s}{6} = 12$
 D) $s + 6 = 12$

22. If $x^{-\frac{1}{2}} = m$, what is x ?

- A) m^2
 B) $1 - m^2$
 C) $\frac{1}{m^2}$
 D) $\frac{1}{m}$

Mathematics—Module 2

1. In the figures below (not drawn to scale), right triangle $\triangle ABC$ is similar to $\triangle EFG$. What is the ratio of the area of $\triangle ABC$ to the area of $\triangle EFG$?



2. The function f is defined by a polynomial. The table below gives values for x and $f(x)$. Which of the following must be a factor of $f(x)$?

x	$f(x)$
0	4
1	2
2	0

- A) x
- B) $x - 1$
- C) $x + 2$
- D) $x - 2$

3. In the system of equations below, a is a constant and x and y are variables. For which of the following values of a will the system have no solution?

$$\begin{aligned}x + 3y &= -7 \\ ax - 2y &= 6\end{aligned}$$

- A) $-\frac{2}{3}$
- B) $-\frac{1}{3}$
- C) 0
- D) $\frac{7}{3}$

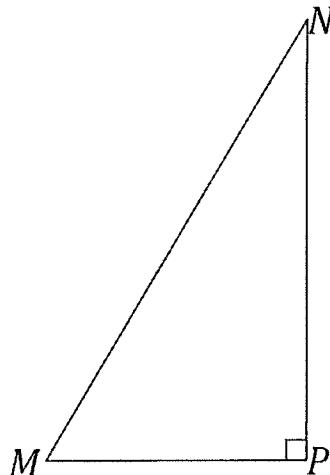
4. What is the sum of all values of x that satisfy the following equation?

$$5x^2 - 30x - 32 = 3$$

- A) -1
- B) 0
- C) 6
- D) 7



5. In right triangle MNP below, angle M measures a° and $\cos a^\circ = \frac{3}{5}$. What is $\cos(90 - a^\circ)$?



6. If 52% of 25 people polled in a coffee survey preferred Brand A and 48% preferred Brand B, which of the following inferences is a logical conclusion?

- A) At least 52% of shoppers will prefer Brand A over Brand B.
- B) The majority of shoppers will prefer Brand A over Brand B.
- C) The majority of shoppers will prefer Brand B over Brand A.
- D) The number of shoppers who prefer Brand A may be similar to the number of shoppers who prefer Brand B.

7. Ben bought a bag of assorted rubber balls and measured each one. Each had a diameter between 1.2 and 1.5 inches. What is a possible volume, rounded to the nearest cubic inch, of one of the balls? Use 3.14 for π .

8. How many gallon jugs of water should Julia buy to completely fill a container in the shape of a rectangular prism if the length is 8 feet, the width is 4 feet, and the height is 3 feet (1 gallon = 231 cubic inches)?

- A) 5
- B) 718
- C) 719
- D) 165,888

9. Subtract the polynomials: $(2x^2 + 3x + 2) - (x^2 + 2x - 3)$

- A) $x^2 + x + 5$
- B) $x^2 + x - 1$
- C) $x^2 + 5x + 5$
- D) $x^2 + 5x - 1$

10. The table below shows the breakdown of orders at a frozen yogurt shop. There were two flavors of yogurt (strawberry and lemon) and two sizes (small and large). If a person among those who ordered frozen yogurt is chosen at random, what is the probability that this person ordered a small serving of lemon yogurt?

	Strawberry	Lemon	Total
Small	12	9	21
Large	20	16	36
Total	32	25	57

- A) $\frac{9}{25}$
 B) $\frac{3}{7}$
 C) $\frac{7}{19}$
 D) $\frac{3}{19}$
11. If (x, y) is the solution to the following system of equations, what is the value of $x + y$?

$$\begin{aligned}3x + y &= -2 \\y &= -x\end{aligned}$$

- A) -1
 B) 0
 C) 1
 D) 2

Refer to the following for questions 12 - 13:

Elise, Max, and Rylie are each offering lawn care services. Their prices for each service are listed in the table below. Prices are per square foot.

	Elise	Max	Rylie
Mowing	\$0.0025	\$0.002	\$0.003
Edging	\$0.0015	\$0.0015	\$0.002
Weeding	\$0.055	\$0.065	\$0.05

12. Rylie was asked to mow and edge a lawn as well as weed a 1,000 square foot garden. If she will spend \$12 on gas and other overhead costs, how large of a lawn does she need to be able to make a \$75 profit?

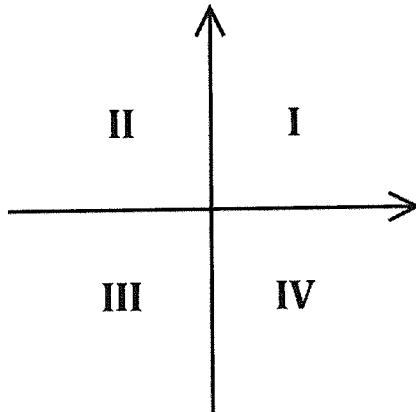
- A) 2,600 ft²
 B) 5,000 ft²
 C) 6,875 ft²
 D) 7,400 ft²

13. Ms. Lin wants to have her 7,500 square foot lawn mowed and edged. She also has a flower bed of x square feet to be weeded. Which of the following inequalities represents x if Elise's services are a better deal than Max's?

- A) $x < 250$
 B) $x < 375$
 C) $x > 250$
 D) $x > 375$

14. A number of cash prizes were awarded for the top salespeople at ABC Communications, each in the amount of \$100, \$200, or \$400. If the prizes totaled \$1,600 and there were 7 total prizes awarded, what is the greatest possible number of \$100 prizes awarded?

15. The graph of the system of inequalities $y \leq \frac{2}{3}x - \frac{3}{2}$ and $y \geq -2x - \frac{5}{2}$ has solutions in which quadrants on the xy -plane below?



- A) Quadrants I and IV
- B) Quadrants II and III
- C) Quadrants I, II, and IV
- D) Quadrants I, III, and IV

16. The equation below is used to solve for the distance, d (meters), that an object travels in a certain amount of time, t (seconds), with an initial velocity of v meters per second. Which of the following equations gives a in terms of d , v , and t ?

$$d = vt + \frac{1}{2}at^2$$

- A) $\frac{2d-2vt}{t}$
- B) $\frac{2dvt}{t^2}$
- C) $\frac{2d}{t^2} - \frac{2v}{t}$
- D) $\frac{2d}{t^2} - 2vt$

17. The function f is defined by a polynomial. The table below gives values for x and $f(x)$. Which of the following must be a factor of $f(x)$?

x	$f(x)$
-5	14
-3	0
-1	-6

- A) $x + 3$
- B) $x - 3$
- C) $x + 5$
- D) $x - 5$



18. Simplify the following expression.

$$(3x + 5)(4x - 6)$$

- A) $12x^2 - 38x - 30$
- B) $12x^2 + 2x - 30$
- C) $12x^2 - 2x - 1$
- D) $12x^2 + 2x + 30$

19. If (x, y) is the solution to the following system of equations, what is the value of $x - y$?

$$\begin{aligned}4x - y &= 11 \\x &= 3y\end{aligned}$$

- A) 0
- B) 1
- C) 2
- D) 3

20. The equation below is used to calculate the period of a pendulum (i.e., the time it takes a pendulum to make one full oscillation). If T refers to the time in seconds, L is the length of the pendulum in meters, and g is the acceleration due to gravity in meters per second squared, which of the following equations gives L in terms of T , g , and π ?

$$T = 2\pi \sqrt{\frac{L}{g}}$$

- A) $(T - 2\pi)^2 g$
- B) $g \sqrt{\frac{T}{2\pi}}$
- C) $\frac{T^2 g}{4\pi^2}$
- D) $\frac{4\pi^2}{T^2 g}$

21. If $x > 0$ and $x^2 - 4x = 12$, what is the value of x ?

22. In the function below, b is a constant. If $f(2) = 0$, what is the value of $f(-1)$?

$$f(x) = \frac{3}{2}x + b$$

- A) $-\frac{9}{2}$
- B) -3
- C) $-\frac{3}{2}$
- D) $\frac{3}{2}$

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SCHOLASTIC APTITUDE TEST (SAT)

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Drill Problems: Week 3.3

Author: Jaehoon Song (Lecturer)

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C O L U M B I A A C A D E M Y

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Written by Jaehoon Song (Lecturer)

1. Circle Equations (10 points)

Circle A in the xy -plane has the equation $(x + 5)^2 + (y - 5)^2 = 4$. Circle B has the same center as circle A. The radius of circle B is two times the radius of circle A. The equation defining circle B in the xy -plane is $(x + 5)^2 + (y - 5)^2 = k$, where k is a constant. What is the value of k ?

Answer:**2. Circle Diameter** (10 points)

What is the diameter of the circle in the xy -plane with equation $(x - 5)^2 + (y - 3)^2 = 16$?

- (A) 4
- (B) 8
- (C) 16
- (D) 32

Answer:**3. Arc and Angle Measure** (10 points)

Point O is the center of a circle. The measure (central angle) of arc RS on this circle is 100° . What is the measure, in degrees, of its associated angle (major-minor relationship) ROS ?

Answer:**4. Circle Radius** (10 points)

The equation $(x + 6)^2 + (y + 3)^2 = 121$ defines a circle in the xy -plane. What is the radius of the circle?

Answer:

5. Tangent Line Slope (10 points)

A circle in the xy -plane has its center at $(-4, -6)$. Line k is tangent to this circle at the point $(-7, -7)$. What is the slope of line k ?

- (A) -3
- (B) $-\frac{1}{3}$
- (C) $\frac{1}{3}$
- (D) 3

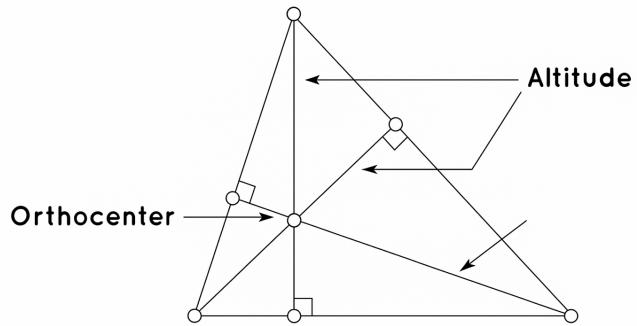
Answer:**6. Triangle Area (10 points)**

Figure 1: reference attached

In triangle ABC , the measure of angle B is 90° and \overline{BD} is an altitude of the triangle. The length of \overline{AB} is 15 and the length of \overline{AC} is 23 greater than the length of \overline{AB} . What is the value of $\frac{\overline{BC}}{\overline{BD}}$?

- (A) $\frac{15}{38}$
- (B) $\frac{15}{23}$
- (C) $\frac{23}{15}$
- (D) $\frac{38}{15}$

Answer:

7. Triangle Angle (10 points)

In $\triangle XYZ$, the measure of $\angle X$ is 24° and the measure of $\angle Y$ is 98° . What is the measure of $\angle Z$?

- (A) 58°
- (B) 74°
- (C) 122°
- (D) 212°

Answer:

**8. Tree Height (10 points)**

Two nearby trees are perpendicular to the ground, which is flat. One of these trees is 10 feet tall and has a shadow that is 5 feet long. At the same time, the shadow of the other tree is 2 feet long. How tall, in feet, is the other tree?

- (A) 3
- (B) 4
- (C) 8
- (D) 27

Answer:



9. Parallel Lines (10 points)

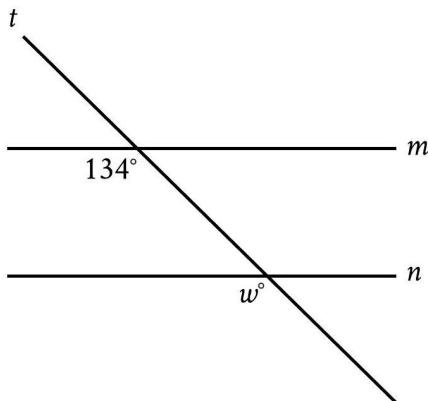


Figure 2: reference attached

In the figure, line m is parallel to line n . What is the value of w ?

- (A) 13
- (B) 34
- (C) 66
- (D) 134

Answer:

□

10. Triangle Congruence (10 points)

In triangles ABC and DEF , angles B and E each have measure 27° and angles C and F each have measure 41° . Which additional piece of information is sufficient to determine whether triangle ABC is congruent to triangle DEF ?

- (A) The measure of angle A
- (B) The length of side AB
- (C) The lengths of sides BC and EF
- (D) No additional information is necessary

Answer:

□

11. Triangle Similarity (10 points)

In triangles LMN and RST , angles L and R each have measure 60° , $LN = 10$, and $RT = 30$. Which additional piece of information is sufficient to prove that triangle LMN is similar to triangle RST ?

- (A) $MN = 7$ and $ST = 7$
- (B) $MN = 7$ and $ST = 21$
- (C) The measures of angles M and S are 70° and 60° , respectively.
- (D) The measures of angles M and T are 70° and 50° , respectively.

Answer:

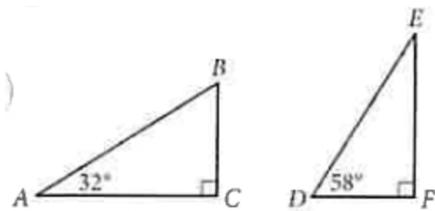
**12. Triangle Ratio (10 points)**

Figure 3: reference attached

Triangles ABC and DEF are shown above. Which of the following is equal to the ratio $\frac{BC}{AB}$?

- (A) $\frac{DE}{DF}$
- (B) $\frac{DF}{DE}$
- (C) $\frac{DF}{EF}$
- (D) $\frac{EF}{DE}$

Answer:



13. Circle Length (10 points)

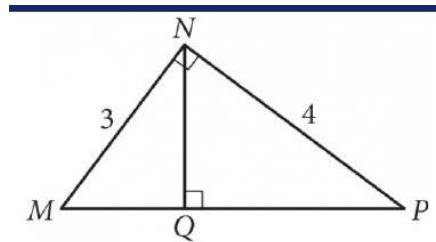


Figure 4: reference attached

In the figure above, what is the length of \overline{NQ} ?

- (A) 2.2
- (B) 2.3
- (C) 2.4
- (D) 2.5

Answer:



14. Triangle Angle (10 points)

Triangle XYZ is similar to triangle RST such that X, Y , and Z correspond to R, S , and T , respectively. The measure of $\angle Z$ is 20° and $2XY = RS$. What is the measure of $\angle T$?

- (A) 2°
- (B) 10°
- (C) 20°
- (D) 40°

Answer:



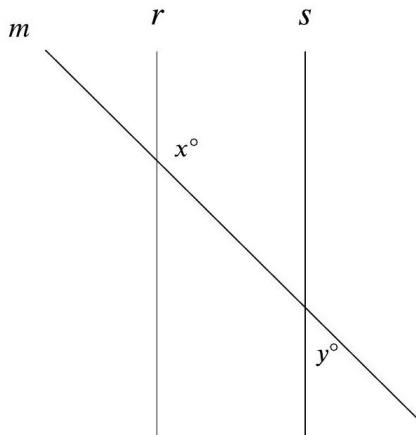
15. Parallel Lines (10 points)

Figure 5: reference attached

Note: Figure not drawn to scale.

In the figure shown, lines r and s are parallel, and line m intersects both lines. If $y < 65$, which of the following must be true?

- (A) $x < 115$
- (B) $x > 115$
- (C) $x + y < 180$
- (D) $x + y > 180$

Answer:

□

16. Trigonometry (10 points)

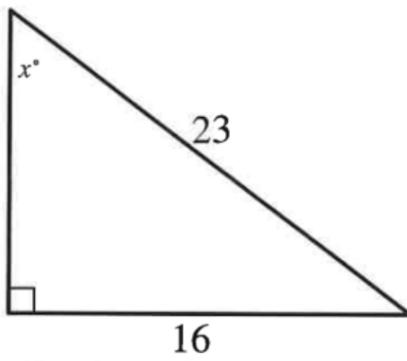


Figure 6: reference attached

In the triangle shown, what is the value of $\sin x^\circ$?

Answer:

□

17. Logo Area (10 points)

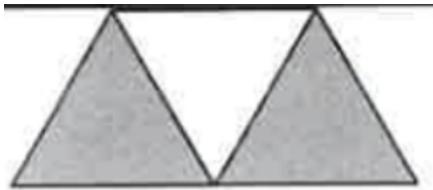


Figure 7: reference attached

A graphic designer is creating a logo for a company. The logo is shown in the figure above. The logo is in the shape of a trapezoid and consists of three congruent equilateral triangles. If the perimeter of the logo is 20 centimeters, what is the combined area of the shaded regions, in square centimeters, of the logo?

- (A) $2\sqrt{3}$
- (B) $4\sqrt{3}$
- (C) $8\sqrt{3}$
- (D) 16

Answer:

□

18. **Triangle Tangent** (10 points)

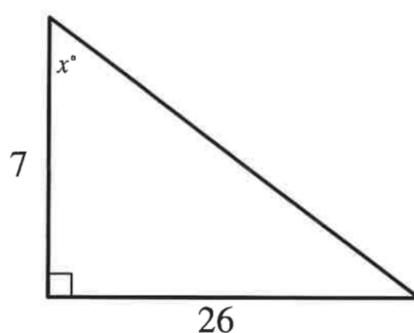


Figure 8: reference attached

In the triangle shown, what is the value of $\tan x^\circ$?

- (A) $\frac{1}{26}$
- (B) $\frac{19}{26}$
- (C) $\frac{26}{7}$
- (D) $\frac{33}{7}$

Answer:



19. **Triangle Height** (10 points)

The perimeter of an equilateral triangle is 624 centimeters. The height of this triangle is $k\sqrt{3}$ centimeters, where k is a constant. What is the value of k ?

Answer:



20. Triangle Length (10 points)

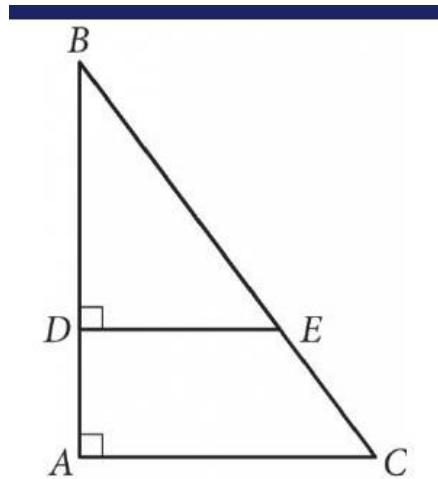


Figure 9: reference attached

In the figure above, $\tan B = \frac{3}{4}$. If $BC = 15$ and $DA = 4$, what is the length of \overline{DE} ?

Answer:

□

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**24. According to the text, *Starry Night* was on display where in 1926?**

Starry Night by Vincent van Gogh, one of the most iconic and beloved paintings in the world, has had a journey that is as fascinating as the artwork itself. Painted in 1889 during the artist's stay at the Saint-Paul-de-Mausole asylum in Saint-Rémy-de-Provence, France, the masterpiece began its odyssey in the possession of Vincent's brother, Theo van Gogh, after the artist's tragic death in 1890.

Upon Theo's passing in 1891, the painting then passed to his widow, Johanna van Gogh-Bonger, who worked tirelessly to promote her brother-in-law's work, ensuring that the world would come to appreciate his genius. In 1900, *Starry Night* found a new home in the Galerie Bernheim-Jeune in Paris.

It was only in 1941 that the painting found its permanent residence at the Museum of Modern Art (MoMA) in New York City. Industrialist and art collector Stephen C. Clark acquired it and generously donated it to the museum. Since then, *Starry Night* has become a centerpiece of MoMA's collection, captivating visitors from around the world with its swirling stars and evocative landscape. Its journey through time and ownership has made it a symbol of artistic transcendence, and it is now celebrated as an integral part of the rich tapestry of art history.

- A) Galerie Bernheim-Jeune in Paris
- B) Museum of Modern Art (MoMA) in New York City
- C) Saint-Paul-de-Mausole asylum in Saint-Rémy-de-Provence, France
- D) The Louvre Museum in Paris, France

25. Which choice completes the text with the most logical and precise word or phrase?

In Nathaniel Hawthorne's *The Scarlet Letter*, the Puritan society of 17th-century New England serves as _____ backdrop for the story of Hester Prynne, a woman condemned for adultery. Hawthorne's novel delves into themes of sin, guilt, and redemption as Hester grapples with the consequences of her actions. The scarlet letter "A" she is forced to wear becomes a symbol of her defiance in the face of societal judgment.

- A) an inconsequential
- B) a traditional
- C) an indifferent
- D) a somber

Mathematics—Module 1

1. The ratio of new car sales to used car sales at the car lot is 3 : 5. If the total car sales were \$287,400 last month, what was the total of the used car sales?



2. A company has been asked to design a building for an athletic event. The building is in the shape of a square pyramid. The pyramid has a height of 481 feet, and the length of each side of the base is 756 feet. What is the approximate volume of the pyramid?

- A) $1.21 \times 10^5 \text{ ft}^3$
- B) $4.85 \times 10^5 \text{ ft}^3$
- C) $9.16 \times 10^7 \text{ ft}^3$
- D) $2.75 \times 10^8 \text{ ft}^3$

3. Simplify the following expression: $(2x^2 + 3x + 2) - (x^2 + 2x - 3)$

- A) $x^2 + x + 5$
- B) $x^2 + x - 1$
- C) $x^2 + 5x + 5$
- D) $x^2 + 5x - 1$

4. Simplify the following: $\frac{x^2}{y^2} + \frac{x}{y^3}$

- A) $\frac{x^3+x}{y^3}$
- B) $\frac{x^2+xy}{y^3}$
- C) $\frac{x^2y+xy}{y^3}$
- D) $\frac{x^2y+x}{y^3}$

5. The graph of $y = -x^2 + 5x$ intersects the graph of $y = 2x$ at $(0, 0)$ and (a, b) . What is the value of b ?

6. Max reads three books averaging 360 pages. Lucy reads five books averaging 200 pages. What is the average length of all the books that Max and Lucy read?

- A) 212 pages
- B) 232 pages
- C) 260 pages
- D) 295 pages

7. Solve: $7x^2 + 6x = -2$.

- A) $x = \frac{-3 \pm \sqrt{23}}{7}$
- B) $x = \pm i\sqrt{5}$
- C) $x = \pm \frac{2i\sqrt{2}}{7}$
- D) $x = \frac{-3 \pm i\sqrt{5}}{7}$

8. Ride Service A charges a flat rate of \$10 for the first 10 miles, plus 25 cents per mile for anything over 10 miles. Ride Service B charges 40 cents per mile. Both services charge the same for a trip that is how long?

- A) 40 miles
- B) 45 miles
- C) 50 miles
- D) 55 miles

9. What is the perimeter of a 45-45-90 triangle if the hypotenuse is 4 inches?

- A) 4 inches
- B) 8 inches
- C) $4 + 4\sqrt{2}$ inches
- D) $4 + 2\sqrt{2}$ inches

10. Which of the following is equivalent to $x^2 + 3 > 2x + 2$?

- A) $x < -1$
- B) $x \neq 1$
- C) $x > 1$
- D) $x < -1$ or $x > 1$

11. In the system of equations below, n is a constant and x and y are variables. For which of the following values of n will the system have no solution?

$$\begin{aligned}3x - y &= 2 \\ nx + 3y &= -5\end{aligned}$$

- A) $-\frac{1}{3}$
- B) 3
- C) $-\frac{5}{3}$
- D) -9

12. Gillian is deciding between two data plans for her cellphone. Plan A provides 2.5 GB of data for a flat rate of \$20/month and charges \$15 per GB for any extra use. Plan B provides unlimited data for \$50/month. What amount of data would Gillian have to use in a month for both plans to cost the same amount?

- A) 2 GB
- B) 3.5 GB
- C) 3.75 GB
- D) 4.5 GB

13. Every person attending a meeting hands out a business card to every other person at the meeting. If a total of 30 cards are handed out, how many people are at the meeting?

- A) 5 people
- B) 6 people
- C) 10 people
- D) 15 people



14. Which of the following is a solution to the inequality $4x - 12 < 4$?

- A) 7
- B) 6
- C) 4
- D) 3

15. The table below shows the breakdown of soup orders at a restaurant. There were two kinds of soup (chicken and veggie) and two sizes (cup and bowl). If a person among those who ordered soup is chosen at random, what is the probability that this person ordered a cup of veggie soup?

	Chicken	Veggie	Total
Cup	7	8	15
Bowl	15	12	27
Total	22	20	42

- A) $\frac{8}{15}$
- B) $\frac{1}{6}$
- C) $\frac{2}{5}$
- D) $\frac{4}{21}$

16. Jamal plants a white petunia for every three red petunias in the flowerbed. If he plants 8 white petunias and r red petunias, which of the following equations is true?

- A) $3r = 8$
- B) $8r = 3$
- C) $\frac{r}{3} = 8$
- D) $r + 3 = 8$

17. Solve $\sqrt{2x} - 3 = \sqrt{2x - 15}$.

- A) $x = 0$
- B) $x = 4$
- C) $x = 8$
- D) $x = 10$

18. What is the solution to the equation: $4\sqrt{x} + 8 = 24$?

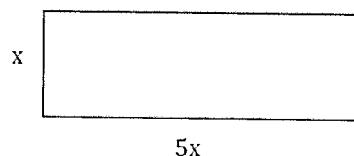
- A) $x = 2$
- B) $x = 4$
- C) $x = 12$
- D) $x = 16$

19. What is the sum of all values of x that satisfy the following equation?

$$3x^2 - 3x - 34 = 2$$

- A) -3
- B) 0
- C) 1
- D) 4

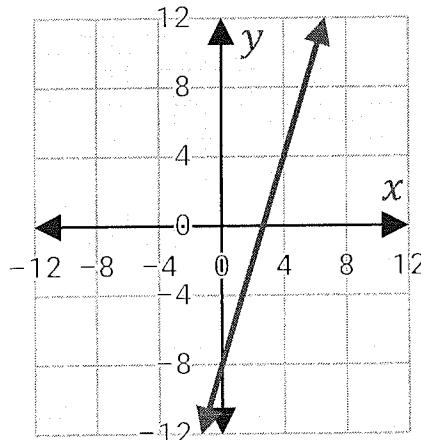
20. The rectangle below has an area of 245 inches^2 . What is the length of the longest side of the rectangle?



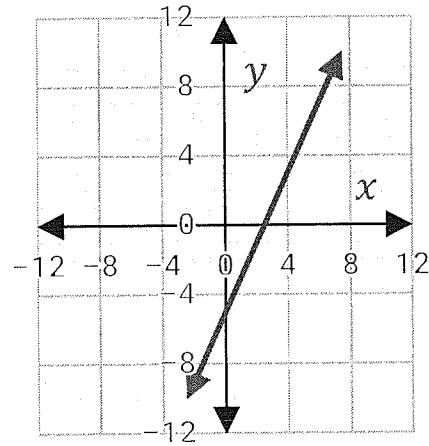
- A) 25 inches
- B) 30 inches
- C) 35 inches
- D) 40 inches

21. The variables x and y have a linear relationship. The table below shows a few sample values. Which of the following graphs correctly represents the linear equation relating x and y ?

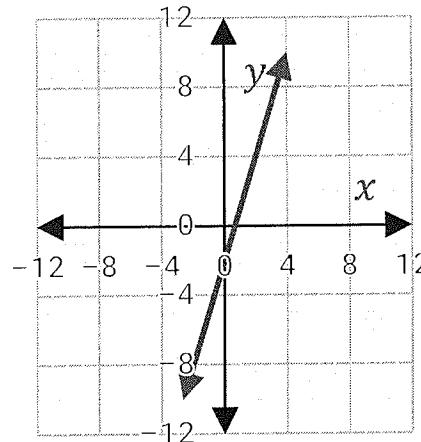
x	y
-2	-11
-1	-8
0	-5
1	-2
2	1



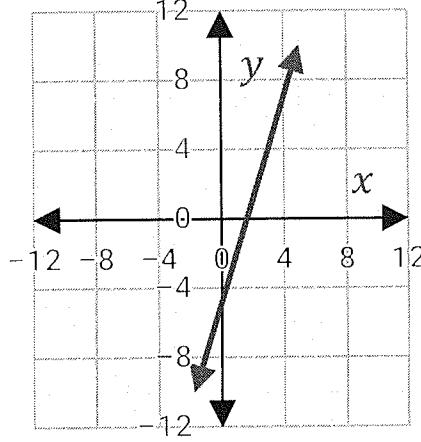
A.



B.



C.



D.

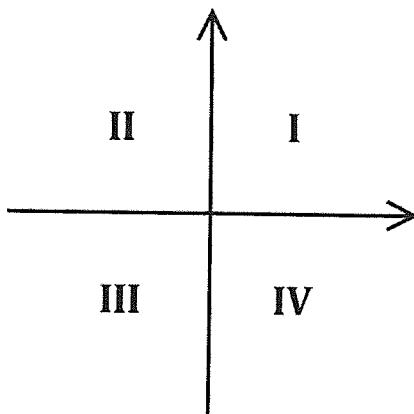
22. Roxana walks x meters west and $x + 20$ meters south to get to her friend's house. On a neighborhood map which has a scale of 1 cm: 10 m, the direct distance between Roxana's house and her friend's house is 10 cm. How far did Roxana walk to her friend's house?

Mathematics—Module 2

1. If $\frac{1}{\sqrt[3]{x}} = a$, what is x ?

- A) a^3
- B) $1 - a^3$
- C) $\frac{1}{a^2}$
- D) $\frac{1}{a^3}$

2. The graph of the system of inequalities $y \leq \frac{1}{4}x - 2$ and $y > 3x - \frac{7}{5}$ has solutions in which quadrants on the xy -plane below?



- A) Quadrant III only
- B) Quadrants II and III
- C) Quadrants III and IV
- D) Quadrants II, III, and IV

Refer to the following for questions 3 - 4:

Nurseries A, B, and C offer various plants for sale, as well as landscaping services to plant the trees and bushes. Prices are listed in the table below.

	A	B	C
Trees	\$25	\$30	\$20
Bushes	\$15	\$20	\$15
Landscaping (per hour)	\$45	\$55	\$50

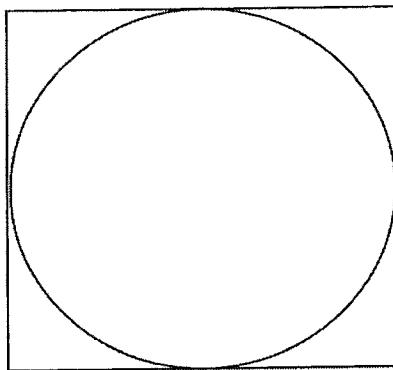
3. Nursery B was hired to plant 100 trees and 100 bushes. If their overhead cost of the plants, equipment, and personnel is \$5,500, how many hours will they have to work to make a profit of \$820?

- A) 15 hours
- B) 21.5 hours
- C) 24 hours
- D) 32.5 hours

4. Isabella plans to hire one of the companies to plant 10 trees and 8 bushes. This project will take x hours. Which of the following inequalities represents x if Nursery A offers a better deal than Nursery C?

- A) $x < 5$
- B) $x < 10$
- C) $x > 5$
- D) $x > 10$

5. A circle is inscribed within a square, as shown. What is the difference between the area of the square and that of the circle, where r is the radius of the circle?



- A) 2π
- B) $\frac{4}{3}\pi r^3$
- C) $r^2(4 - \pi)$
- D) $2\pi r$

6. The equation below shows Emma's savings plan. She set aside an initial lump sum and adds to it on a monthly basis. If i is the total investment in cents and m is the number of months since she began, how much does she save each month?

$$i = 50,000 + 4,500m$$

- A) \$45
- B) \$500
- C) \$4,500
- D) \$50,000

7. Solve for n in the equation: $4n - p = 3r$

- A) $\frac{3r}{4} - p$
- B) $p + 3r$
- C) $p - 3r$
- D) $\frac{3r}{4} + \frac{p}{4}$



8. If the solution for the system of equations below is (x, y) , what is the value of $2x^2 - y$?

$$\begin{aligned}3x - 2y &= 0 \\-2x + 4y &= -8\end{aligned}$$

- A) -3
- B) -2
- C) 5
- D) 11

9. What is the y -coordinate of the center of the circle defined in the equation below?

$$x^2 + y^2 - y - 6x = -\frac{21}{4}$$

10. Riley has several \$5 bills, \$10 bills, and \$20 bills. If she has a total of 9 bills that add up to \$80, what is the greatest number of \$5 bills she could have?

11. Which of the following represents the factored form of the expression $x^2 - 3x - 40$?

- A) $(x - 8)(x + 5)$
- B) $(x - 7)(x + 4)$
- C) $(x + 10)(x - 4)$
- D) $(x + 6)(x - 9)$

12. A new business is calculating the amount of products that must sell to break even (so that investments equal profits). If d dollars are invested to produce a products that can be sold for p profit, how much investment is required, according to the equations below?

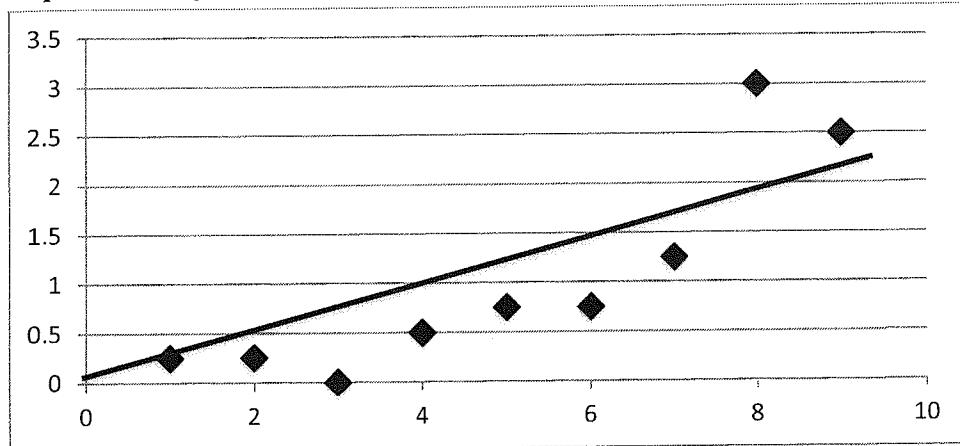
$$\begin{aligned}d &= 9,660 + 1.2a \\p &= 4a\end{aligned}$$

- A) \$3,450
- B) \$4,140
- C) \$11,260
- D) \$13,800

13. If 3 times the square of a positive number is 48, what is the result when twice the number is subtracted from 15?

- A) -7
- B) 4
- C) 7
- D) 11

14. The scatterplot below shows Zac's time (in hours) on the y -axis spent working on his science project on the days (x -axis) leading up to the due date. Approximately how much longer did he spend on Day 8 than the amount predicted by the line of best fit?

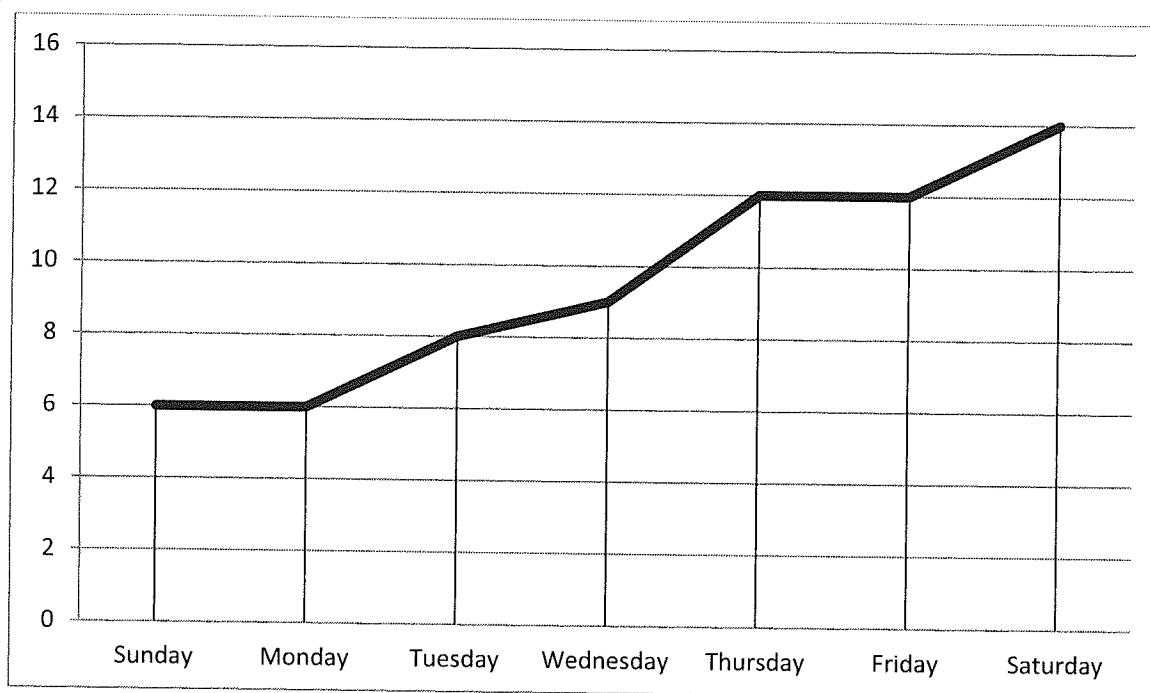


- A) 0.5 hours
B) 1 hour
C) 2 hours
D) 3 hours
15. If $x > 0$ and $x^2 - 7 = 9$, what is the value of x ?

16. If $\frac{3}{7}q = -6$, what is the value of q ?
- A) -14
B) $-\frac{18}{7}$
C) $-\frac{45}{7}$
D) -42

17. What is the expanded form of $(x + 6)(x - 6)$?
- A) $x^2 - 12x - 36$
B) $x^2 + 12x - 36$
C) $x^2 + 12x + 36$
D) $x^2 - 36$

Refer to the following for questions 18 - 19:



Every time Miguel gets quarters in change, he puts them in a jar. The chart above shows how many quarters he has in the jar at the end of each day during a particular week.

18. How many quarters did Miguel add on Monday?

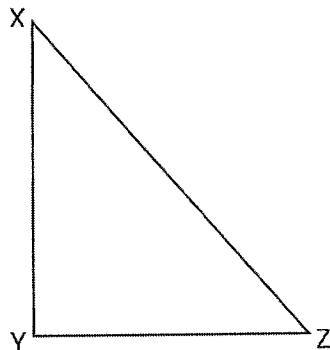
- A) 0
- B) 1
- C) 3
- D) 6

19. Which day did Miguel add the most quarters to the jar?

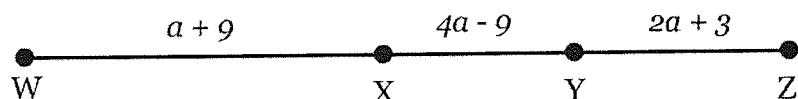
- A) Monday
- B) Tuesday
- C) Thursday
- D) Saturday

20. The half-life of caffeine in the human body is 5 hours. If Rafe drinks a cup of coffee at 7:00 a.m., what percentage of the caffeine is still in his system at 2:00 p.m.? Round your answer to the nearest whole percent.

21. In right triangle ΔXYZ below, angle Z measures z° and $\sin z^\circ = \frac{4}{5}$. What is $\cos(90 - z)^\circ$?



22. On line WZ below, $WX = XZ$. What is the length of WY ? (Note: figure not drawn to scale)



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SCHOLASTIC APTITUDE TEST (SAT)

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Drill Problems: Week 3.5

Author: Jaehoon Song (Lecturer)

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C O L U M B I A A C A D E M Y

enrichment beyond the classroom

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Written by Jaehoon Song (Lecturer)

1. Data Set Comparison (10 points)

Value	Data set A frequency	Data set B frequency
30	2	9
34	4	7
38	5	5
42	7	4
46	9	2

Data set A and data set B each consist of 27 values. The table shows the frequencies of the values for each data set. Which of the following statements best compares the means of the two data sets?

- (A) The mean of data set A is greater than the mean of data set B .
- (B) The mean of data set A is less than the mean of data set B .
- (C) The mean of data set A is equal to the mean of data set B .
- (D) There is not enough information to compare the means of the data sets.

Answer:



2. Data Set Transformation (10 points)

A data set of 27 different numbers has a mean of 33 and a median of 33. A new data set is created by adding 7 to each number in the original data set that is greater than the median and subtracting 7 from each number in the original data set that is less than the median. Which of the following measures does NOT have the same value in both the original and new data sets?

- (A) Median
- (B) Mean
- (C) Sum of the numbers
- (D) Standard deviation

Answer:



3. Median Calculation (10 points)

What is the median of the data shown?

73, 74, 75, 77, 79, 82, 84, 85, 91

Answer:

**4. International Tourist Arrivals (10 points)**

International Tourist Arrivals, in millions		
Country	2012	2013
France	83.0	84.7
United States	66.7	69.8
Spain	57.5	60.7
China	57.7	55.7
Italy	46.4	47.7
Turkey	35.7	37.8
Germany	30.4	31.5
United Kingdom	26.3	32.2
Russia	24.7	28.4

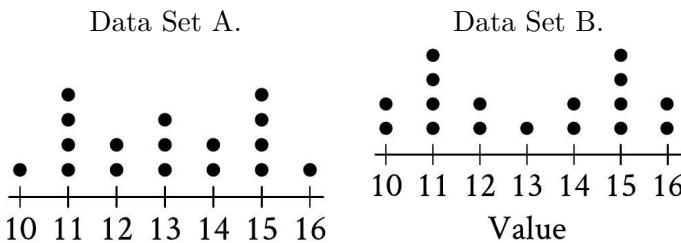
The table above shows the number of international tourist arrivals, rounded to the nearest tenth of a million, to the top nine tourist destinations in both 2012 and 2013. Based on the information given in the table, how much greater, in millions, was the median number of international tourist arrivals to the top nine tourist destinations in 2013 than the median number in 2012, to the nearest tenth of a million?

Answer:



5. Dot Plot Analysis (10 points)

The dot plots represent the distributions of values in data sets *A* and *B*.



Which of the following statements must be true?

- (I) The median of data set *A* is equal to the median of data set *B*.
 - (II) The standard deviation of data set *A* is equal to the standard deviation of data set *B*.
- (A) I only
(B) II only
(C) I and II
(D) Neither I nor II

Answer:



6. Histogram Analysis (10 points)

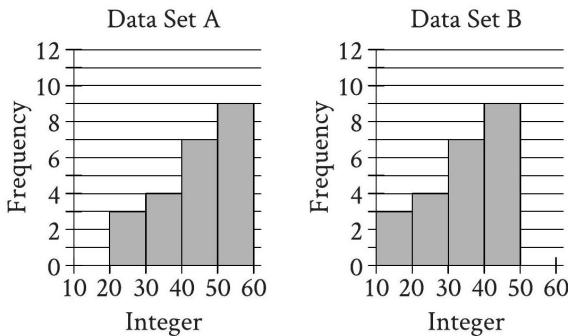


Figure 1: reference attached

Two data sets of 23 integers each are summarized in the histograms shown. For each of the histograms, the first interval represents the frequency of integers greater than or equal to 10, but less than 20. The second interval represents the frequency of integers greater than or equal to 20, but less than 30, and so on. What is the smallest possible difference between the mean of data set *A* and the mean of data set *B*?

- (A) 0
- (B) 1
- (C) 10
- (D) 23

Answer:

□

7. Mean Calculation (10 points)

What is the mean of the data shown?

$$2, 9, 14, 23, 32$$

- (A) 14
- (B) 16
- (C) 17
- (D) 32

Answer:

□

8. Frequency Distribution (10 points)

Value	Frequency (probability)
1	a
2	$2a$
3	$3a$
4	$2a$
5	a

The frequency distribution above summarizes a set of data, where a is a positive integer. How much greater is the mean of the set of data than the median?

- (A) 0
- (B) 1
- (C) 2
- (D) 3

Answer:



9. Team Race Times (10 points)

Two different teams consisting of 10 members each ran in a race. Each member's completion time of the race was recorded. The mean of the completion times for each team was calculated and is shown below.

Team A: 3.41 minutes

Team B: 3.79 minutes

Which of the following MUST be true?

- (I) Every member of team A completed the race in less time than any member of team B .
 - (II) The median time it took the members of team B to complete the race is greater than the median time it took the members of team A to complete the race.
 - (III) There is at least one member of team B who took more time to complete the race than some member of team A .
- (A) III only
 - (B) I and III only
 - (C) II and III only
 - (D) I, II, and III

Answer:



10. Basketball Score (10 points)

The mean score of 8 players in a basketball game was 14.5 points. If the highest individual score is removed, the mean score of the remaining 7 players becomes 12 points. What was the highest score?

- (A) 20
- (B) 24
- (C) 32
- (D) 36

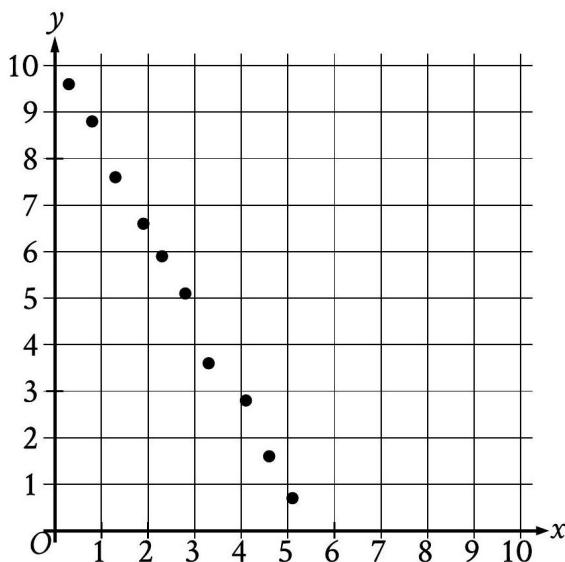
Answer:**11. Linear Model (10 points)**

Figure 2: reference attached

Which of the following equations is the most appropriate linear model for the data shown in the scatterplot?

- (A) $y = -1.9x - 10.1$
- (B) $y = -1.9x + 10.1$
- (C) $y = 1.9x - 10.1$
- (D) $y = 1.9x + 10.1$

Answer:

12. Stopping Distance (10 points)

A study was done to determine a new car's stopping distance when it was traveling at different speeds. The study was done on a dry road with good surface conditions. The results are shown below, along with the graph of a quadratic function that models the data.

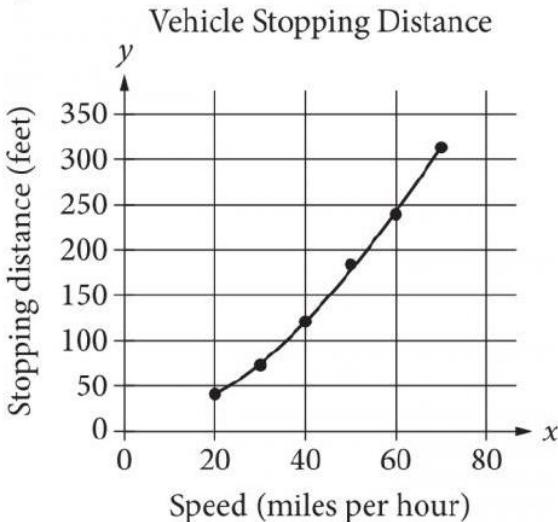


Figure 3: reference attached

According to the model, which of the following is the best estimate for the stopping distance, in feet, if the vehicle was traveling 55 miles per hour?

- (A) 25
- (B) 30
- (C) 210
- (D) 250

Answer:



13. Temperature Change (10 points)

The scatterplot shows the temperature y , in $^{\circ}\text{F}$, recorded by a meteorologist at various times x , in days since June 1.

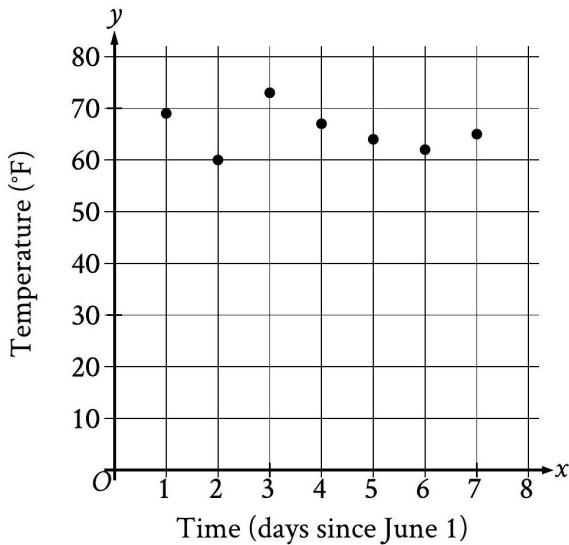


Figure 4: reference attached

During which of the following time periods did the greatest increase in recorded temperature take place?

- (A) From $x = 6$ to $x = 7$
- (B) From $x = 5$ to $x = 6$
- (C) From $x = 2$ to $x = 3$
- (D) From $x = 1$ to $x = 2$

Answer:



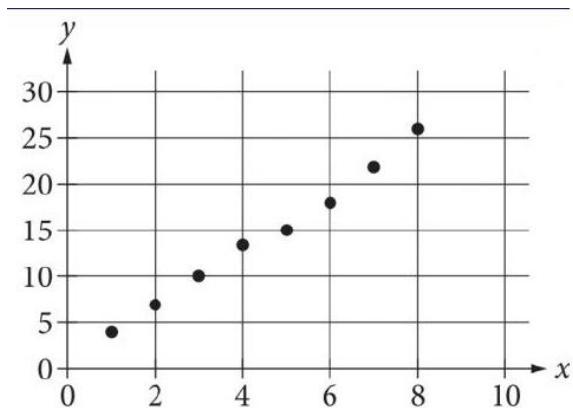
14. Line of Best Fit (10 points)

Figure 5: reference attached

Which of the following could be the equation for a line of best fit for the data shown in the scatterplot above?

- (A) $y = 3x + 0.8$
- (B) $y = 0.8x + 3$
- (C) $y = -0.8x + 3$
- (D) $y = -3x + 0.8$

Answer:



15. Energy Generation (10 points)

The scatterplot below shows the amount of electric energy generated, in millions of megawatt-hours, by nuclear sources over a 10-year period.

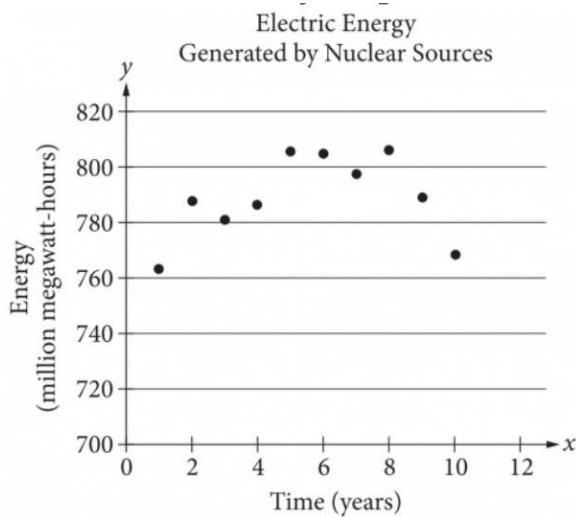


Figure 6: reference attached

Of the following equations, which best models the data in the scatterplot?

- (A) $y = 1.674x^2 + 19.76x - 745.73$
- (B) $y = -1.674x^2 - 19.76x - 745.73$
- (C) $y = 1.674x^2 + 19.76x + 745.73$
- (D) $y = -1.674x^2 + 19.76x + 745.73$

Answer:



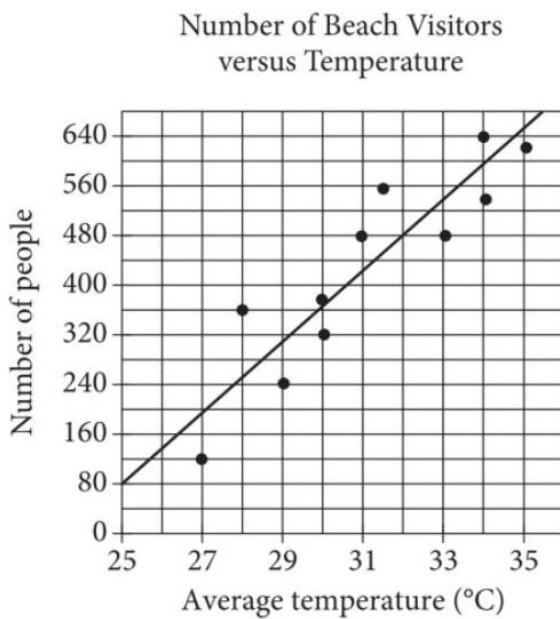
16. Beach Visitors (10 points)

Figure 7: reference attached

Each dot in the scatterplot above represents the temperature and the number of people who visited a beach in Lagos, Nigeria, on one of eleven different days. The line of best fit for the data is also shown. According to the line of best fit, what is the number of people, rounded to the nearest 10, predicted to visit this beach on a day with an average temperature of 32°C ?

- (A) 440
- (B) 460
- (C) 480
- (D) 500

Answer:

17. Chipmunk Population (10 points)

The line graph shows the estimated number of chipmunks in a state park on April 1 of each year from 1989 to 1999.

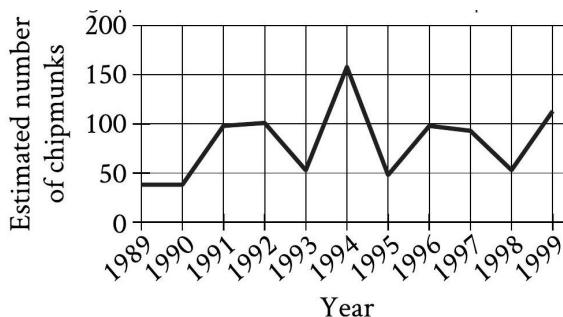


Figure 8: reference attached

Based on the line graph, in which year was the estimated number of chipmunks in the state park the greatest?

- (A) 1989
- (B) 1994
- (C) 1995
- (D) 1998

Answer:

**18. Nonlinear Relationship (10 points)**

In which of the following tables is the relationship between the values of x and their corresponding y -values nonlinear?

(A)	<table border="1"> <thead> <tr> <th>x</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <th>y</th> <td>8</td> <td>11</td> <td>14</td> <td>17</td> </tr> </tbody> </table>	x	1	2	3	4	y	8	11	14	17
x	1	2	3	4							
y	8	11	14	17							
(B)	<table border="1"> <thead> <tr> <th>x</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <th>y</th> <td>4</td> <td>8</td> <td>12</td> <td>16</td> </tr> </tbody> </table>	x	1	2	3	4	y	4	8	12	16
x	1	2	3	4							
y	4	8	12	16							
(C)	<table border="1"> <thead> <tr> <th>x</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <th>y</th> <td>8</td> <td>13</td> <td>18</td> <td>23</td> </tr> </tbody> </table>	x	1	2	3	4	y	8	13	18	23
x	1	2	3	4							
y	8	13	18	23							
(D)	<table border="1"> <thead> <tr> <th>x</th> <th>1</th> <th>2</th> <th>3</th> <th>4</th> </tr> </thead> <tbody> <tr> <th>y</th> <td>6</td> <td>12</td> <td>24</td> <td>48</td> </tr> </tbody> </table>	x	1	2	3	4	y	6	12	24	48
x	1	2	3	4							
y	6	12	24	48							

Answer:



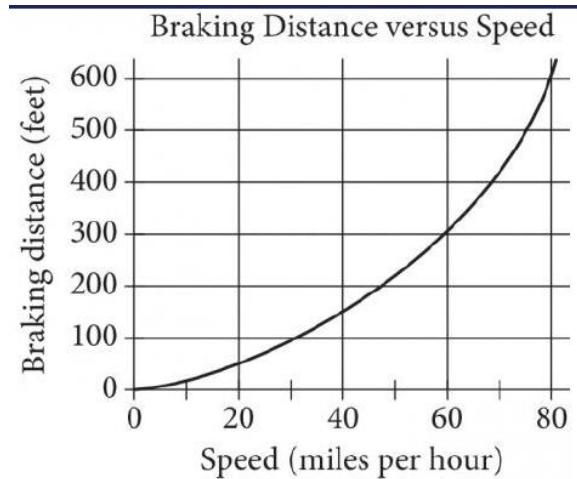
19. Braking Distance (10 points)

Figure 9: reference attached

The graph above shows the relationship between the speed of a particular car, in miles per hour, and its corresponding braking distance, in feet. Approximately how many feet greater will the car's braking distance be when the car is traveling at 50 miles per hour than when the car is traveling at 30 miles per hour?

- (A) 75
- (B) 125
- (C) 175
- (D) 250

Answer:

20. Line of Best Fit (10 points)

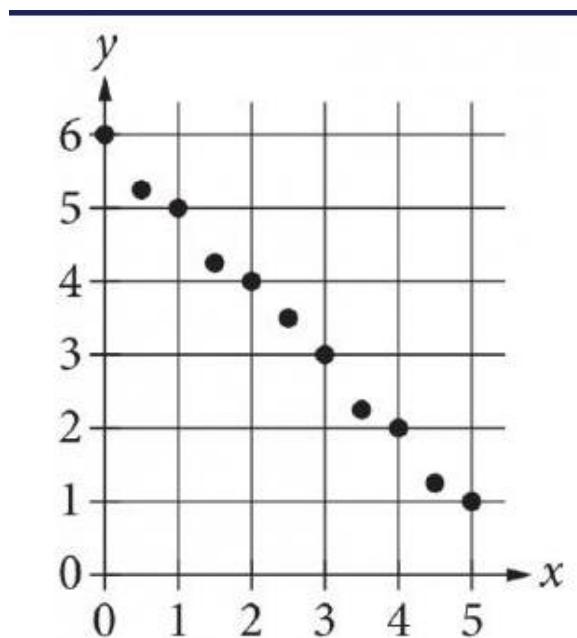


Figure 10: reference attached

Which of the following could be an equation for a line of best fit for the data in the scatterplot?

- (A) $y = -x + 6$
- (B) $y = -x - 6$
- (C) $y = 6x + 1$
- (D) $y = 6x - 1$

Answer:



21. Wind Turbine (10 points)

A wind turbine completes 900 revolutions in 50 minutes. At this rate, how many revolutions per minute does this turbine complete?

- (A) 18
- (B) 850
- (C) 950
- (D) 1,400

Answer:



22. Constant Ratio (10 points)

x	y
1	4
3	12
5	20
40	k

In the table above, the ratio of y to x for each ordered pair is constant. What is the value of k ?

- (A) 28
- (B) 36
- (C) 80
- (D) 160

Answer:



23. Tree Growth (10 points)

Species of tree	Growth factor
Red maple	4.5
River birch	3.5
Cottonwood	2.0
Black walnut	4.5
White birch	5.0
American elm	4.0
Pin oak	3.0
Shagbark hickory	7.5

One method of calculating the approximate age, in years, of a tree of a particular species is to multiply the diameter of the tree, in inches, by a constant called the growth factor for that species. The table above gives the growth factors for eight species of trees. If a white birch tree and a pin oak tree each now have a diameter of 1 foot, which of the following will be closest to the difference, in inches, of their diameters 10 years from now? (1 foot = 12 inches)

- (A) 1.0
- (B) 1.2
- (C) 1.3
- (D) 1.4

Answer:



24. Ratio (10 points)

The ratio of t to u is 1 to 2, and $t = 10$.

What is the value of u ?

- (A) 2
- (B) 5
- (C) 10
- (D) 20

Answer:



25. Depth Conversion (10 points)

A special camera is used for underwater ocean research. When the camera is at a depth of 58 fathoms, what is the camera's depth in feet? (1 fathom = 6 feet)

Answer:



26. Oak Density (10 points)

A sample of oak has a density of 807 kilograms per cubic meter. The sample is in the shape of a cube, where each edge has a length of 0.90 meters. To the nearest whole number, what is the mass, in kilograms, of this sample?

- (A) 588
- (B) 726
- (C) 897
- (D) 1,107

Answer:



27. Average Speed (10 points)

On April 18, 1775, Paul Revere set off on his midnight ride from Charlestown to Lexington. If he had ridden straight to Lexington without stopping, he would have traveled 11 miles in 26 minutes. In such a ride, what would the average speed of his horse have been, to the nearest tenth of a mile per hour?

Answer:





28. Length Conversion (10 points)

How many yards are equivalent to 612 inches? (1 yard = 36 inches)

- (A) 0.059
- (B) 17
- (C) 576
- (D) 22,032

Answer:



29. Rectangle Ratio (10 points)

Rectangle A has length 15 and width w . Rectangle B has length 20 and the same length-to-width ratio as rectangle A . What is the width of rectangle B in terms of w ?

- (A) $\frac{4}{3}w$
- (B) $w + 5$
- (C) $\frac{3}{4}w$
- (D) $w - 5$

Answer:



30. Card Ratio (10 points)

Shaquan has 7 red cards and 28 blue cards. What is the ratio of red cards to blue cards that Shaquan has?

- (A) 1 to 4
- (B) 4 to 1
- (C) 1 to 7
- (D) 7 to 1

Answer:



31. Plant Growth (10 points)

Last year, Cedric had 35 plants in his garden. This year, the number of plants in Cedric's garden is 60% greater than the number of plants in his garden last year. How many plants does Cedric have in his garden this year?

Answer:





32. **Percentage** (10 points)

What is 23% of 100?

- (A) 23
- (B) 46
- (C) 77
- (D) 123

Answer:



33. **Percentage Increase** (10 points)

Which expression represents the result of increasing a positive quantity w by 43%?

- (A) $1.43w$
- (B) $0.57w$
- (C) $43w$
- (D) $0.43w$

Answer:



34. **Population Growth** (10 points)

The population of City A increased by 7% from 2015 to 2016. If the 2016 population is k times the 2015 population, what is the value of k ?

- (A) 0.07
- (B) 0.7
- (C) 1.07
- (D) 1.7

Answer:



35. **Percentage** (10 points)

What is 10% of 470?

- (A) 37
- (B) 47
- (C) 423
- (D) 460

Answer:



36. Percentage Increase (10 points)

Which of the following represents the result of increasing the quantity x by 9%, where $x > 0$?

- (A) $1.09x$
- (B) $0.09x$
- (C) $x + 9$
- (D) $x + 0.09$

Answer:

**37. Percentage Greater (10 points)**

The number k is 36% greater than 50. If k is the product of 50 and r , what is the value of r ?

- (A) 36
- (B) 3.6
- (C) 1.36
- (D) 0.36

Answer:

**38. Percentage Comparison (10 points)**

The number a is 70% less than the positive number b . The number c is 80% greater than a . The number c is how many times b ?

Answer:

**39. Percentage Greater (10 points)**

210 is $p\%$ greater than 30. What is the value of p ?

Answer:

**40. Percentage Greater (10 points)**

The value of z is 1.13 times 100. The value of z is what percent greater than 100?

- (A) 11.3
- (B) 13
- (C) 130
- (D) 213

Answer:



41. Survey Analysis (10 points)

A city has 50 city council members. A reporter polled a random sample of 20 city council members and found that 6 of those polled supported a specific bill. Based on the sample, which of the following is the best estimate of the number of city council members in the city who support the bill?

- (A) 6
- (B) 9
- (C) 15
- (D) 30

Answer:**42. Fish Weight Study (10 points)**

A study was done on the weights of different types of fish in a pond. A random sample of fish were caught and marked in order to ensure that none were weighed more than once. The sample contained 150 largemouth bass, of which 30% weighed more than 2 pounds. Which of the following conclusions is best supported by the sample data?

- (A) The majority of all fish in the pond weigh less than 2 pounds.
- (B) The average weight of all fish in the pond is approximately 2 pounds.
- (C) Approximately 30% of all fish in the pond weigh more than 2 pounds.
- (D) Approximately 30% of all largemouth bass in the pond weigh more than 2 pounds.

Answer:**43. Hiking Survey (10 points)**

A park ranger asked a random sample of visitors how far they hiked during their visit. Based on the responses, the estimated mean was found to be 4.5 miles, with an associated margin of error of 0.5 miles. Which of the following is the best conclusion from these data?

- (A) It is likely that all visitors hiked between 4 and 5 miles.
- (B) It is likely that most visitors hiked exactly 4.5 miles.
- (C) It is not possible that any visitor hiked less than 3 miles.
- (D) It is plausible that the mean distance hiked for all visitors is between 4 and 5 miles.

Answer:

44. Kitten Characteristics (10 points)

Coat color	Eye color		
	Deep blue	Light brown	Total
Cream-tortoiseshell	16	16	32
Chocolate	12	4	16
Total	28	20	48

The data on the coat color and eye color for 48 Himalayan kittens available for adoption were collected and summarized in the table above. What fraction of the chocolate-colored kittens has deep blue eyes?

- (A) $\frac{12}{48}$
- (B) $\frac{12}{28}$
- (C) $\frac{16}{32}$
- (D) $\frac{12}{16}$

Answer:



45. Internship Data (10 points)

High school	Year				
	2008	2009	2010	2011	2012
Foothill	87	80	75	76	70
Valley	44	54	65	76	82
Total	131	134	140	152	152

The table above shows the number of students from two different high schools who completed summer internships in each of five years. No student attended both schools. Of the students who completed a summer internship in 2010, which of the following represents the fraction of students who were from Valley High School?

- (A) $\frac{10}{140}$
- (B) $\frac{65}{140}$
- (C) $\frac{75}{140}$
- (D) $\frac{65}{75}$

Answer:



46. Singing Lessons (10 points)

Voice type	Number of singers
Countertenor	4
Tenor	6
Baritone	10
Bass	5

A total of 25 men registered for singing lessons. The frequency table shows how many of these singers have certain voice types. If one of these singers is selected at random, what is the probability he is a baritone?

- (A) 0.10
- (B) 0.40
- (C) 0.60
- (D) 0.67

Answer:



47. Sports Survey (10 points)

A survey taken by 1,000 students at a school asked whether they played school sports. The table below summarizes all 1,000 responses from the students surveyed.

	Males	Females
Play a school sport	312	220
Do not play a school sport	?	216

How many of the males surveyed responded that they do not play a school sport?

- (A) 109
- (B) 252
- (C) 468
- (D) 688

Answer:



48. Blood Type Distribution (10 points)

Rhesus factor	Blood type			
	A	B	AB	O
+	33	9	3	37
-	7	2	1	x

Human blood can be classified into four common blood types-A, B, AB, and O. It is also characterized by the presence (+) or absence (-) of the rhesus factor. The table above shows the distribution of blood type and rhesus factor for a group of people. If one of these people who is rhesus negative (-) is chosen at random, the probability that the person has blood type B is $\frac{1}{9}$. What is the value of x ?

Answer:



49. Survey Generalization (10 points)

A survey was conducted using a sample of history professors selected at random from the California State Universities. The professors surveyed were asked to name the publishers of their current texts. What is the largest population to which the results of the survey can be generalized?

- (A) All professors in the United States
- (B) All history professors in the United States
- (C) All history professors at all California State Universities
- (D) All professors at all California State Universities

Answer:



50. Dog Park Survey (10 points)

The members of a city council wanted to assess the opinions of all city residents about converting an open field into a dog park. The council surveyed a sample of 500 city residents who own dogs. The survey showed that the majority of those sampled were in favor of the dog park. Which of the following is true about the city council's survey?

- (A) It shows that the majority of city residents are in favor of the dog park.
- (B) The survey sample should have included more residents who are dog owners.
- (C) The survey sample should have consisted entirely of residents who do not own dogs.
- (D) The survey sample is biased because it is not representative of all city residents.

Answer:



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Math**35 MINUTES, 22 QUESTIONS****DIRECTIONS**

The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

NOTES

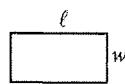
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REFERENCE

$$A = \pi r^2$$

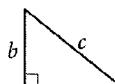
$$C = 2\pi r$$



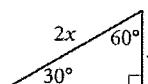
$$A = lw$$



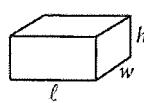
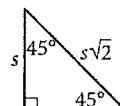
$$A = \frac{1}{2}bh$$



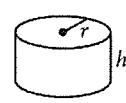
$$c^2 = a^2 + b^2$$



Special Right Triangles



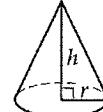
$$V = lwh$$



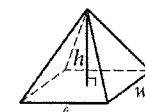
$$V = \pi r^2 h$$



$$V = \frac{4}{3}\pi r^3$$



$$V = \frac{1}{3}\pi r^2 h$$



$$V = \frac{1}{3}lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.



Practice Test 3

2

Module
1

2

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1

$$3(y - \frac{5}{3}) = 10$$

What value of y is the solution to the given equation?

- A) 5
- B) 3
- C) $\frac{5}{3}$
- D) 10

2

$$|x - 5| \leq 7$$

Which of the following inequalities is equivalent to the inequality above?

- A) $-7 \leq x \leq 7$
- B) $-2 \leq x \leq 12$
- C) $x \leq 2$ or $x \geq 12$
- D) $x \leq -12$ or $x \geq 2$

3

If $f(x) = -8x + 9$ and $f(k) = -15$, what is the value of k ?

4

The length of a swimming pool is 4 times its width. If the width is 25 meters, what is the area of the swimming pool, in square meters?

- A) 625
- B) 1875
- C) 2500
- D) 1250

5

Let the function f be defined by $f(x) = (x^6 - 8x^9 + x^2) + (x^2 + 8x^9 - x^6)$. What is the value of $f(8)$?

- A) 128
- B) 4096
- C) 64
- D) 256

6

In the x - y -plane, line l passes through the point $(5, 1)$ and is parallel to the line with the equation $y = -\frac{2}{5}x + \frac{7}{2}$. What is the equation of line l ?

- A) $y = \frac{2}{5}x + 3$
- B) $y = -\frac{2}{5}x - 3$
- C) $y = -\frac{2}{5}x + 3$
- D) $y = \frac{5}{2}x + 3$

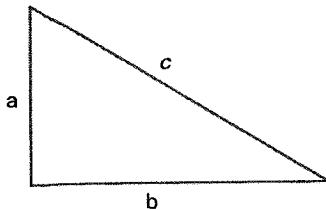
Practice Test 3

2

Module
1

2

7



The length of three sides of the triangle are a , b , and c . Which of the following is/are true?

- I. $a + b > c$
- II. $|a - c| < b$
- III. $a^2 + b^2 = c^2$
- A) I only
- B) II only
- C) I and II and III
- D) I and III

8

In the x - y -plane, what is the y -intercept of the function $y = (x + 3)^2 - 6$?

- A) $(-3, -6)$
- B) $(0, -6)$
- C) $(0, 3)$
- D) $(\sqrt{6}, 0)$

9

In the x - y -plane, a circle has center $(0, 8)$ and radius 9. Point $(0, k)$ is on the circle and k is a positive constant. What is the value of k ?

- A) 17
- B) -1
- C) 9
- D) 1

10

$$y = 80(1 + 12\%)^t$$

The Royal Yacht Club was established in 1985 with 80 members. The equation above models the number of the members y , where t is the number of years since 1985. Which of the following equations models the number of members in the yacht club m months since 1985?

- A) $y = 80(1 + 12\%)^{\frac{m}{6}}$
- B) $y = 80(1 + 12\%)^{12m}$
- C) $y = 80(1 + 12\%)^{\frac{m}{12}}$
- D) $y = 80(1 + 12\%)^{\frac{m}{4}}$

11

Jay exercises by briskly walking everyday at a constant speed of 5 mph. If Jay walks 3 hours per day, how many miles has Jay walked in the past 20 days?

- A) 100
- B) 15
- C) 300
- D) 60

12

23, 25, 32, 27, 40, 37, 35

What is the median of the given data set?

- A) 27
- B) 32
- C) 29.5
- D) 33.5

13

A group of 90 people go hiking. A sample of people among the group was selected at random and asked whether they prefer hike a 5 km trail or a 10 km trail. The results show that 70% of the sample respond that they prefer the 10 km trail. Based on the survey, how many people in the group would prefer the 5 km trail?

- A) 63
- B) 90
- C) 27
- D) 20

14

$$\begin{aligned}y - 6 &= 5 \\(y - 6)^2 &= x + 3\end{aligned}$$

Which of the following coordinates, (x, y) , is a solution to the given system of equations?

- A) (22,11)
- B) (25,11)
- C) (19,11)
- D) (11,11)

15

The function is defined by $f(x) = x^3 + x^2 + 3$. What is the value of $f(-2)$?

- A) -1
- B) 7
- C) 15
- D) -9

16

76 students went on a field trip together in 5 school buses. Some of the buses can hold 12 students each, while the rest of the buses can hold 20 students each. How many of the buses can hold 20 students? (assuming each bus reached its maximum capacity)

17

A donut machine makes donuts at a rate of 5760 donuts in 8 hours. At this rate, how many donuts does this machine produce per minute?

18

Joanna buys 80 holiday cards. If she gives 55% of the cards to her friends, how many cards does she have left?

- A) 44
- B) 28
- C) 36
- D) 30

19

Which expression is equivalent to $8x^3 + 6x^2$?

- A) $2x^3(4 + 6x)$
- B) $2x^2(4x + 3)$
- C) $4x^2(2x + 3)$
- D) $2x^2(4 + 3x)$

Practice Test 3

2

Module
1

2

20

A rectangle has an area of 48 centimeters and length of 6 centimeters. What is the perimeter of this rectangle, in centimeters?

21

Which expression is equivalent to $\frac{5}{2}x^2 - (\frac{3}{2}x^2 - \frac{1}{6}x^2)$?

- A) $\frac{5}{3}x^2$
- B) $2x^2$
- C) $\frac{2}{3}x^2$
- D) $3x^2$

22

A company plans on holding an anniversary party. The total cost, y , for the party can be estimated by the linear equation $y = A + Bx$, where x represents the number of participants and A and B are constants. If there are 50 participants, the total cost is \$1525. If there are 80 participants, the total cost is \$2290. What is the value of A ?

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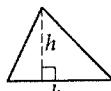
REFERENCE

$$A = \pi r^2$$

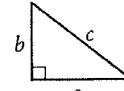
$$C = 2\pi r$$



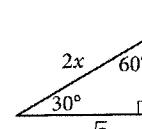
$$A = l w$$



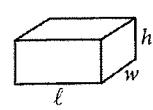
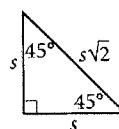
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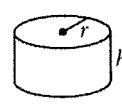
$$c^2 = a^2 + b^2$$



Special Right Triangles



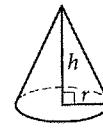
$$V = l w h$$



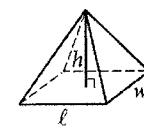
$$V = \pi r^2 h$$



$$V = \frac{4}{3} \pi r^3$$



$$V = \frac{1}{3} \pi r^2 h$$



$$V = \frac{1}{3} l w h$$

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Practice Test 3

2

Module
2

2

1

If $2 + \frac{3}{25}x^2 = 5$, what is the negative value of $x + 1$?

2

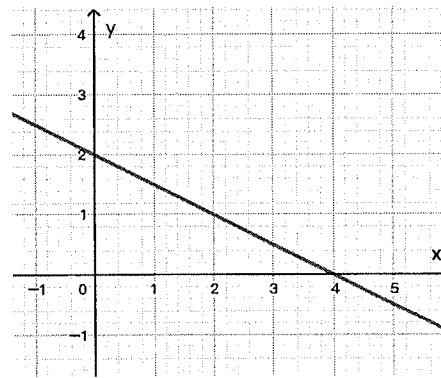
If $f(x) = 2x^2 + bx - 2$, where b is a constant and $f(2) = 8$, what is the value of $f(5)$?

3

A store sells apples for x dollars per pound and oranges for y dollars per pound. When Emily buys 3 pounds of apples and 5 pounds of oranges, the total cost is 17 dollars. When Emily buys 5 pounds of apples and 3 pounds of oranges, the total cost is 15 dollars. Which of the following systems of equations represents this situation?

- A) $5x + 3y = 17$
 $3x + 5y = 15$
- B) $5x + 3y = 15$
 $5x - 3y = 17$
- C) $3x + 5y = 17$
 $5x + 3y = 15$
- D) $3x + 5y = 15$
 $5x + 3y = 17$

4



The equation $ax - by = 12$ is shown in the graph above, where a and b are constants. What is the value of a ?

- A) 4
- B) 2
- C) 6
- D) 3

5

Data set A contains the heights of the 10 students in Ms. Kelly's class who participated in the basketball team, in which the mean height is 175 cm. Data set B contains the heights of the 40 students in Ms. Kelly's class who are not in the basketball team, in which the mean height is 165 cm. What is the mean height, in cm, of the 50 students in Ms. Kelly's class?

6

$$y = ax^2 + 16x + 5$$

The given equation relates the variables x and y , where a is a constant. The value of y reaches its maximum value when $x = 4$. What is the maximum value of y ?

- A) 4
- B) 37
- C) 2
- D) 8

7

In the right triangle MQP, the length of the hypotenuse is $13x$ and the length of one leg is $5x$. What is the length of the other leg?

- A) $4x$
- B) $12x$
- C) 12
- D) $8x$

8

Alex paid \$614.88 for a watch, of which the 5% HST tax was \$27.45 and the 7% QST tax was \$38.43. Which of the following expressions does not provide the price-before-tax of the watch, x ?

- A) $x(1 + 7\% + 5\%) = 614.88$
- B) $x \cdot 7\% = 38.43$
- C) $x \cdot 5\% = 27.45$
- D) $x = 614.88(1 + 7\% + 5\%)$

9

A bacteria population doubles every five hours. If the initial bacteria population is 1200 and the function $P(t)$ gives the bacteria population size after t hours, which of the following functions defines $P(t)$?

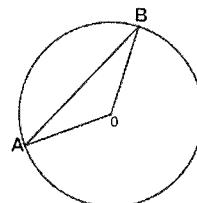
- A) $P(t) = 1200(2)^{5t}$
- B) $P(t) = 1200(\frac{1}{2})^{5t}$
- C) $P(t) = 1200(\frac{1}{2})^{\frac{t}{5}}$
- D) $P(t) = 1200(2)^{\frac{t}{5}}$

10

The function $y = f(x)$ is defined by $f(x) = 8x - k$, where k is a constant. The y -intercept of the graph in the x - y -plane is $(0, 5)$. What is the value of k ?

- A) 5
- B) -5
- C) -8
- D) 8

11



In the figure shown above, the point O is the center of the circle and the angle of $\angle AOB$ is $\frac{2}{3}\pi$ radians. How many degrees is the angle $\angle AOB$?

Practice Test 3

2

Module
2

2

12

$$(2x + 5) - (3 - x)$$

Which of the following is equivalent to the given expression?

- A) $x + 8$
- B) $3x + 8$
- C) $3x + 2$
- D) $x + 2$

13

The equation above can be used to calculate the distance d , in miles, traveled by a car moving at an average speed of 45 miles per hour. For any positive constant n , the distance the car traveled after $6n$ hours is how many times the distance the car traveled after $2n$ hours?

- A) 2
- B) $3k$
- C) 3
- D) $2k$

14

When the quadratic function f is graphed in the x - y -plane, where $y = f(x)$, its vertex is $(2, 4)$. If one of the x -intercepts of this graph is $(-1, 0)$, what is the other x -intercept?

- A) $(4, 0)$
- B) $(7, 0)$
- C) $(5, 0)$
- D) $(6, 0)$

15

$$\begin{aligned}y &= 6x + 24 \\3y &= 14x + 2y\end{aligned}$$

The solution to the given system of equations is (m, n) , where m and n are constants. What is the value of $m - n$?

- A) 39
- B) 45
- C) -39
- D) 24

16

There are three metal spheres with radii of 6, 8, and 10, respectively. If these three metal spheres are melted together to make one large metal sphere, what is the radius of the large metal sphere?

- A) 12
- B) 24
- C) 1720
- D) 18

17

Amy wrote 26 Valentine's Day cards to her friends on Saturday and Sunday. On Sunday, she wrote 2 more than 2 times the number of cards that she wrote on Saturday. How many Valentine's Day cards did Amy write on Sunday?

18

Which expression is equivalent to $9x^2 + 3$?

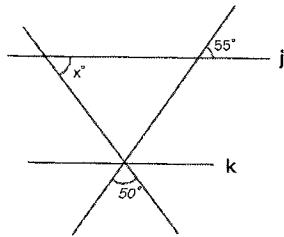
- A) $(3x + 5)(3x - 5) - 28$
- B) $(3x + 5)(3x - 5) + 28$
- C) $3(x + 2)(x - 2) - 15$
- D) $3(x + 2)(x - 2) + 9$

19

If $2^{2m} = a^{\frac{2}{5}}$ and $2^{2n} = b^{\frac{2}{5}}$, which of the following is equivalent to $(\frac{a}{b})^2$?

- A) 4^{m-n}
- B) 32^{m-n}
- C) 64^{m-n}
- D) 1024^{m-n}

20



In the figure above, lines j and k are parallel. What is the value of x ?

22

$$y = \frac{2x + p}{x - p}$$

The equation above expresses y in terms of p and x . Which of the following equations expresses x in terms of p and y ?

- A) $x = \frac{p(y - 1)}{y - 2}$
- B) $x = \frac{p(y + 1)}{y + 2}$
- C) $x = \frac{py}{y + p}$
- D) $x = \frac{p(y + 1)}{y - 2}$

21

Data Set A

Value	Frequency
15	2
16	2
17	2
18	2
19	1
20	2

Data Set B

Value	Frequency
15	1
16	1
17	6
18	3
19	2
20	2

Data Set A and B are shown in the tables above. Which of the following statements best compares the standard deviation and the means of the two data sets?

- A) The mean of Data Set A is greater than the mean of Data Set B, and the standard deviation of Data Set A is greater than the standard deviation of Data Set B.
- B) The mean of Data Set A is greater than the mean of Data Set B, and the standard deviation of Data Set A is less than the standard deviation of Data Set B.
- C) The mean of Data Set A is less than the mean of Data Set B, and the standard deviation of Data Set A is greater than the standard deviation of Data Set B.
- D) The mean of Data Set A is less than the mean of Data Set B, and the standard deviation of Data Set A is less than the standard deviation of Data Set B.

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SCHOLASTIC APTITUDE TEST (SAT)

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Drill Problems: Week 3.7

Author: Jaehoon Song (Lecturer)

Release: 2025-06-20 00:32:45-04:00

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C O L U M B I A A C A D E M Y

enrichment beyond the classroom

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Written by Jaehoon Song (Lecturer)

1. X-Intercept (10 points)

The x -intercept of the graph shown is $(x, 0)$. What is the value of x ?

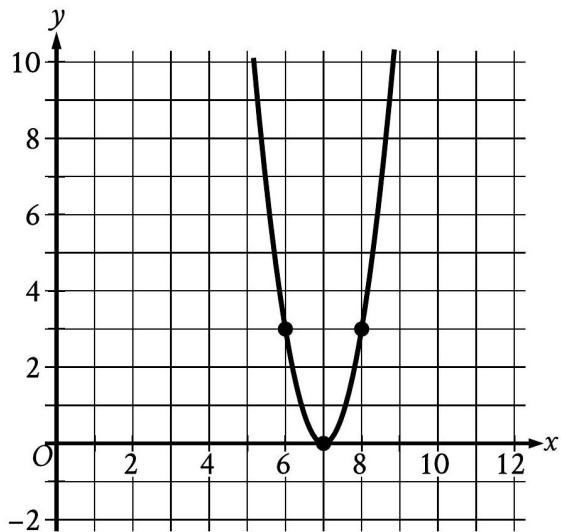


Figure 1: reference attached

Answer:



2. Graph Equation (10 points)

Which of the following could be the equation of the graph shown in the xy -plane?

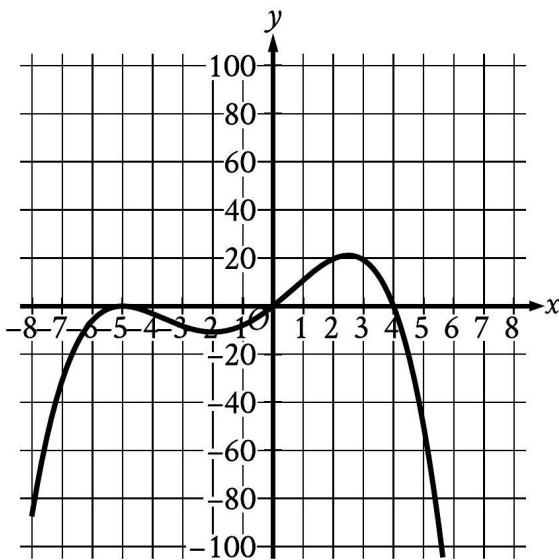


Figure 2: reference attached

- (A) $y = -\frac{1}{10}x(x - 4)(x + 5)$
- (B) $y = -\frac{1}{10}x(x - 4)(x + 5)^2$
- (C) $y = -\frac{1}{10}x(x - 5)(x + 4)$
- (D) $y = -\frac{1}{10}x(x - 5)^2(x + 4)$

Answer:

**3. Function Translation (10 points)**

$$f(x) = 4x^2 + 64x + 262$$

The function g is defined by $g(x) = f(x + 5)$. For what value of x does $g(x)$ reach its minimum?

- (A) -13
- (B) -8
- (C) -5
- (D) -3

Answer:



4. Polynomial Roots (10 points)

The graph of $y = f(x)$ is shown, where the function f is defined by $f(x) = ax^3 + bx^2 + cx + d$ and a, b, c , and d are constants. For how many values of x does $f(x) = 0$?

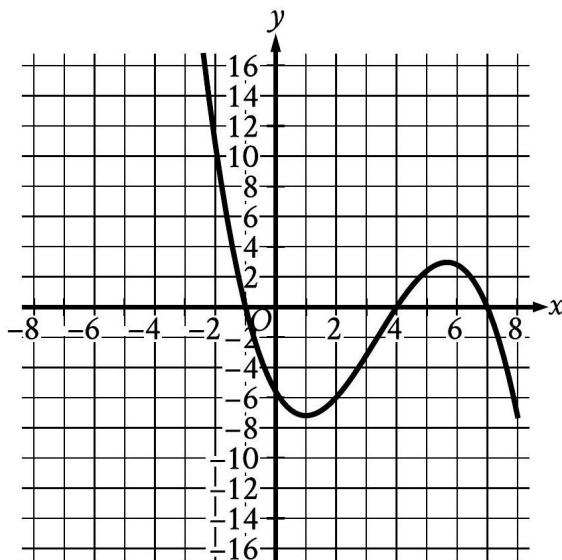


Figure 3: reference attached

- (A) One
- (B) Two
- (C) Three
- (D) Four

Answer:

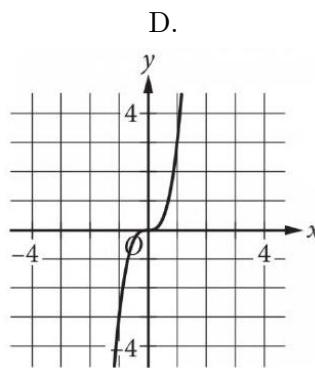
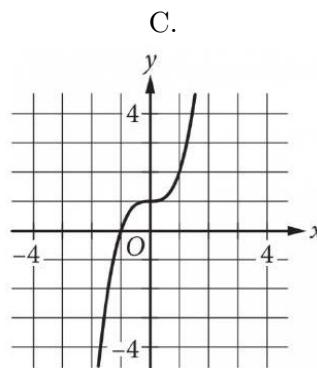
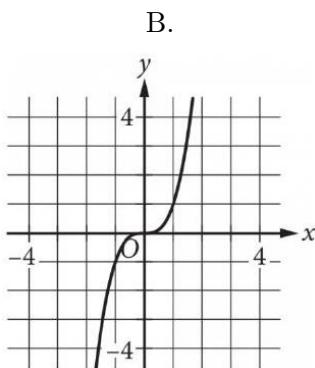
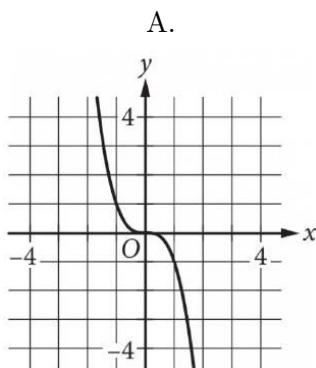


5. Data Representation (10 points)

The table shown includes some values of x and their corresponding values of y .

x	y
0	0
1	1
2	8
3	27

Which of the following graphs in the xy -plane could represent the relationship between x and y ?



Answer:

**6. Function Translation (10 points)**

The function f is defined by $f(x) = (x - 6)(x - 2)(x + 6)$. In the xy -plane, the graph of $y = g(x)$ is the result of translating the graph of $y = f(x)$ up 4 units. What is the value of $g(0)$?

Answer:

**7. Rectangle Area (10 points)**

A rectangle has a length of x units and a width of $(x - 15)$ units. If the rectangle has an area of 76 square units, what is the value of x ?

- (A) 4
- (B) 19
- (C) 23
- (D) 76

Answer:



8. Exponential Growth (10 points)

A scientist initially measures 12,000 bacteria in a growth medium. 4 hours later, the scientist measures 24,000 bacteria. Assuming exponential growth, the formula $P = C(2)^{rt}$ gives the number of bacteria in the growth medium, where r and C are constants and P is the number of bacteria t hours after the initial measurement. What is the value of r ?

- (A) $\frac{1}{12,000}$
- (B) $\frac{1}{4}$
- (C) 4
- (D) 12,000

Answer:**9. Projectile Motion (10 points)**

A quadratic function models a projectile's height, in meters, above the ground in terms of the time, in seconds, after it was launched. The model estimates that the projectile was launched from an initial height of 7 meters above the ground and reached a maximum height of 51.1 meters above the ground 3 seconds after the launch. How many seconds after the launch does the model estimate that the projectile will return to a height of 7 meters?

- (A) 3
- (B) 6
- (C) 7
- (D) 9

Answer:**10. Quadratic Minimum (10 points)**

The given equation relates the variables x and y :

$$y = x^2 - 14x + 22$$

For what value of x does the value of y reach its minimum?

Answer:

11. Polynomial Simplification (10 points)

Which expression is equivalent to $11x^3 - 5x^3$?

- (A) $16x^3$
- (B) $6x^3$
- (C) $6x^6$
- (D) $16x^6$

Answer:

**12. Polynomial Addition (10 points)**

Which expression is equivalent to $50x^2 + 5x^2$?

- (A) $250x^2$
- (B) $10x^2$
- (C) $45x^2$
- (D) $55x^2$

Answer:

**13. Polynomial Multiplication (10 points)**

The expression $(3x - 23)(19x + 6)$ is equivalent to the expression $ax^2 + bx + c$, where a , b , and c are constants. What is the value of b ?

Answer:

**14. Expression Simplification (10 points)**

Which expression is equivalent to $20w - (4w + 3w)$?

- (A) $10w$
- (B) $13w$
- (C) $19w$
- (D) $21w$

Answer:



15. Rational Expression (10 points)

Which expression is equivalent to $\frac{4}{4x-5} - \frac{1}{x+1}$?

- (A) $\frac{1}{(x+1)(4x-5)}$
- (B) $\frac{3}{3x-6}$
- (C) $-\frac{1}{(x+1)(4x-5)}$
- (D) $\frac{9}{(x+1)(4x-5)}$

Answer:

**16. Linear Expression (10 points)**

Which of the following is equivalent to $3(x + 5) - 6$?

- (A) $3x - 3$
- (B) $3x - 1$
- (C) $3x + 9$
- (D) $15x - 6$

Answer:

**17. Rational Expression (10 points)**

In the expression

$$\frac{x^2 - c}{x - b}$$

, b and c are positive integers. If the expression is equivalent to $x + b$ and $x \neq b$, which of the following could be the value of c ?

- (A) 4
- (B) 6
- (C) 8
- (D) 10

Answer:





18. **Radical Expression** (10 points)

Which of the following expressions is equivalent to $\sqrt[3]{x^3y^6}$?

- (A) y^2
- (B) xy^2
- (C) y^3
- (D) xy^3

Answer:



19. **Polynomial Multiplication** (10 points)

Which expression is equivalent to $(d - 6)(8d^2 - 3)$?

- (A) $8d^3 - 14d^2 - 3d + 18$
- (B) $8d^3 - 17d^2 + 48$
- (C) $8d^3 - 48d^2 - 3d + 18$
- (D) $8d^3 - 51d^2 + 48$

Answer:



20. **Square Difference** (10 points)

If $x^2 = a + b$ and $y^2 = a + c$, which of the following is equal to $(x^2 - y^2)^2$?

- (A) $a^2 - 2ac + c^2$
- (B) $b^2 - 2bc + c^2$
- (C) $4a^2 - 4abc + c^2$
- (D) $4a^2 - 2abc + b^2c^2$

Answer:



21. **System of Equations** (10 points)

If the ordered pair (x, y) satisfies the system of equations

$$\begin{aligned}y &= x^2 - 4x + 4 \\y &= 4 - x\end{aligned}$$

what is one possible value of x ?

Answer:



22. Wave Equation (10 points)

An oceanographer uses the equation

$$s = \frac{3}{2}p$$

to model the speed s , in knots, of an ocean wave, where p represents the period of the wave, in seconds. Which of the following represents the period of the wave in terms of the speed of the wave?

- (A) $p = \frac{2}{3}s$
- (B) $p = \frac{3}{2}s$
- (C) $p = \frac{2}{3} + s$
- (D) $p = \frac{3}{2} + s$

Answer:**23. Quadratic Equation (10 points)**

Which of the following is a solution to the equation $2x^2 - 4 = x^2$?

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Answer:**24. Linear Equation (10 points)**

The given equation relates the positive numbers q , r , and s :

$$q - 29r = s$$

Which equation correctly expresses q in terms of r and s ?

- (A) $q = s - 29r$
- (B) $q = s + 29r$
- (C) $q = 29rs$
- (D) $q = -\frac{s}{29r}$

Answer:

25. Quadratic Solutions (10 points)

In the given equation, a and b are positive constants:

$$57x^2 + (57b + a)x + ab = 0$$

The product of the solutions to the given equation is kab , where k is a constant. What is the value of k ?

- (A) $\frac{1}{57}$
- (B) $\frac{1}{19}$
- (C) 1
- (D) 57

Answer:

**26. Quadratic No Solutions (10 points)**

In the given equation, b is a positive integer:

$$-x^2 + bx - 676 = 0$$

The equation has no real solution. What is the greatest possible value of b ?

Answer:

**27. Rational Equation (10 points)**

The given equation relates the distinct positive numbers p , k , and j :

$$p = \frac{k}{4j + 9}$$

Which equation correctly expresses $4j + 9$ in terms of p and k ?

- (A) $4j + 9 = \frac{k}{p}$
- (B) $4j + 9 = kp$
- (C) $4j + 9 = k - p$
- (D) $4j + 9 = \frac{p}{k}$

Answer:

**28. Quadratic Expression (10 points)**

If $3x^2 - 18x - 15 = 0$, what is the value of $x^2 - 6x$?

Answer:



29. Intersection Point (10 points)

In the xy -plane, what is the y -coordinate of the point of intersection of the graphs of $y = (x - 1)^2$ and $y = 2x - 3$?

Answer:**30. Quadratic No Solutions (10 points)**

In the equation $2x^2 - 4x = t$, t is a constant. If the equation has no real solutions, which of the following could be the value of t ?

- (A) -3
- (B) -1
- (C) 1
- (D) 3

Answer:

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Math

22 QUESTIONS
(TIME: 35 MIN)

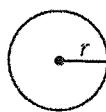
DIRECTIONS

The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

NOTES

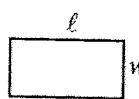
Unless otherwise indicated:

- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

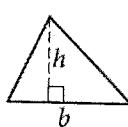
REFERENCE

$$A = \pi r^2$$

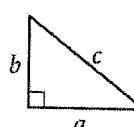
$$C = 2\pi r$$



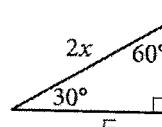
$$A = l w$$



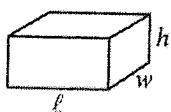
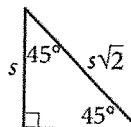
$$A = \frac{1}{2} b h$$



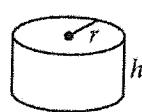
$$c^2 = a^2 + b^2$$



Special Right Triangles



$$V = lwh$$



$$V = \pi r^2 h$$



$$V = \frac{4}{3} \pi r^3$$



$$V = \frac{1}{3} \pi r^2 h$$



$$V = \frac{1}{3} lwh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

For multiple-choice questions, solve each problem, choose the correct answer from the choices provided, and then circle your answer in this book. Circle only one answer for each question. If you change your mind, completely erase the circle. You will not get credit for questions with more than one answer circled, or for questions with no answers circled.

For student-produced response questions, solve each problem and write your answer next to or under the question in the test book as described below.

- Once you've written your answer, circle it clearly. You will not receive credit for anything written outside the circle, or for any questions with more than one circled answer.
- If you find **more than one correct answer**, write and circle only one answer.
- Your answer can be up to 5 characters for a **positive** answer and up to 6 characters (including the negative sign) for a **negative** answer, but no more.
- If your answer is a **fraction** that is too long (over 5 characters for positive, 6 characters for negative), write the decimal equivalent.
- If your answer is a **decimal** that is too long (over 5 characters for positive, 6 characters for negative), truncate it or round at the fourth digit.
- If your answer is a **mixed number** (such as $3\frac{1}{2}$), write it as an improper fraction ($\frac{7}{2}$) or its decimal equivalent (3.5).
- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

$$\sqrt{4(x - m)} = x - m$$

In the given equation above, where m is a positive constant. The greatest solution is 6. What is the value of m ?

3

$$\begin{aligned}x - 2y &= -1 \\-3 + 3x &= 4y - 2\end{aligned}$$

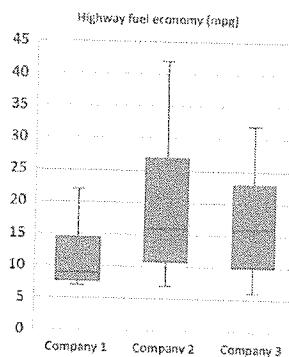
The solution to the system of equations above is (x, y) . What is the value of $2x$?

- A) 2
- B) 3
- C) 4
- D) 6

2

A computer processes at a constant rate of 82 data per second. At what rate, in data per minutes, does the computer processes the data?

4



Customer Reports released highway fuel economy data (mpg) of three companies for 10 years (2011-2021). Which company shows the largest range of highway fuel economy from the boxplot above?

- A) Company 1
- B) Company 2
- C) Company 3
- D) All companies have the same range

5

ANNUAL PERCENT CHANGE IN SALES AT TIRE STORES
FROM 2020 TO 2022

STORE	Percent change 2020-2021	Percent change 2021-2022
A	20	-20
B	-10	10
C	15	-15

If the sales in dollar at Store B was \$12,000 for 2020, what was the dollar amount of sales at the store for 2022?

- A) \$12,000
- B) \$11,880
- C) \$11,730
- D) \$11,520

7

PETER'S MATH SCORE REPORT

	Percent of grade	Cumulative Scores
Homework	10	90
Attendance	10	100
Tests / Quizzes	60	87
Final Test	20	

The table above shows the distribution of the cumulative scores of each portion of Peter's Math Grade before his final test. If grade A is required to get the cumulative combined scores greater than or equal to 90 in his math class, what is the lowest score he need to get for the final test in order to achieve grade A?

- A) 96
- B) 95
- C) 94
- D) 93

6

$$\begin{aligned}y + mx &= 3 \\y &= x^2 - 2m\end{aligned}$$

In the system of equations above, If the equations are graphed in the XY-plane, their graphs intersect at two points assuming m is a constant. Which of the following cannot be the value of m?

- A) 0
- B) -1
- C) -3
- D) -7

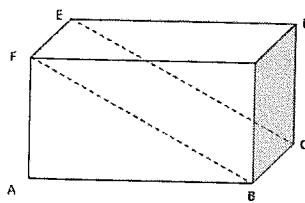
8

Which of the following expressions is equivalent to $8x^3y^4 - 32x^7y^2$?

- A) $8x^7y^4(y^3 - x^2)$
- B) $-8x^3y^4(-1 + 4x^4y^4)$
- C) $8x^3y^2(y - 2x^2)(y + 2x^2)$
- D) $8x^3y^2(y^2 - 4x^2)$

CONTINUE

9



In the rectangular solid above, If $AB = 4$, $BC = 5$, and $CD = 3$, What is the area of rectangular region $BCEF$?

- A) 20
- B) 25
- C) $4\sqrt{34}$
- D) $3\sqrt{41}$

10

If the difference of two angles U and N is $\frac{5\pi}{36}$ radians ($U > N$) and the measure of angle is U is $\frac{\pi}{3}$ radians, what is the measure of angle N , in degrees?

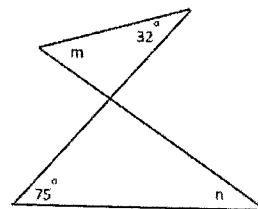
- A) 20
- B) 25
- C) 30
- D) 35

11

$$f(x) = -2x^2 + 4x + m$$

In the function above, if m is a unknown constant, for what value of x does the function have the same value of $f(-2)$?

12

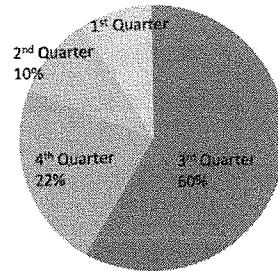


In the figure above, what is the value of $m - n$?

- A) -33
- B) -43
- C) 33
- D) 43

13

INTERNET SHOE SALES BY PERCENT FOR 2022



The circle graph above shows the distribution of Shoe sales for ABC shop in 2022. What is the nearest degree of the central angle for 1st Quarter sales?

15

List A and list B contain 50 numbers and 60 numbers respectively. If the mean of list A is 25 and the mean of list B is 34, what is the positive difference in their sums?

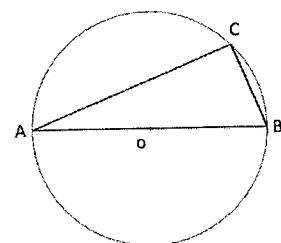
14

$$5f + 6s + 12j = 1,230$$

A school consists of 5 freshmen classes, 6 sophomore classes, and 12 junior classes. The total number of students who has a social media account is 1,230. The equation above represents the situation. What is the best interpretation of s in the context?

- A) The total number of sophomore students in the school
- B) The total number of sophomore students who has social media account in the school
- C) The average number of sophomore students who has social media account in the school
- D) The average number of students who has social media account in the school

16



If the diameter (\overline{AB}) of the circle O above is 10 and $BC = 6$, what is the area of triangle ABC?

- A) 24
- B) 28
- C) 30
- D) 32

17

19

$$\frac{x(xy^2)^4}{x^4y^3} = x^m y^n$$

$$\frac{1}{2}k - y = \frac{7}{2}$$

In the equation above, if $xy \neq 0$, what is the value of $m + n$?

$$-2x + 4y = -14$$

In the system of equations above, for a real number k , which of the following points lies on the graph of each equation?

- A) $\left(k, \frac{k}{2} + \frac{7}{2}\right)$
- B) $(2k + 7, k)$
- C) $(k, 7 + 2k)$
- D) $(2k - 7, k)$

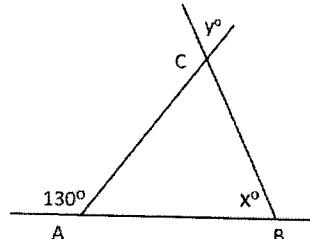
18

20

The function f has the property for all x that

$$2f(x) = f(2x)$$

If $f(2) = 4$, what is the value of $f(1)$?



Note: not drawn to scale

In the figure above, assuming $AB = BC$, what is the value of $x + y$?

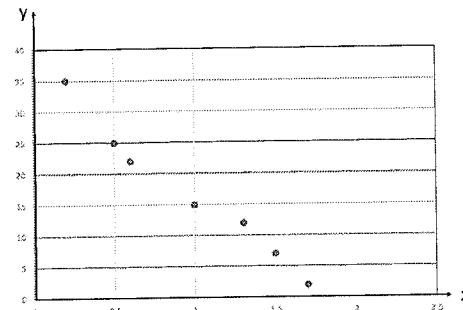
21

$$2x^2 + 4x + 2y^2 - 8y = -4$$

In the circle equation above, what is the area of the circle?

- A) π
- B) 3π
- C) 6π
- D) $\sqrt{6}\pi$

22



Which of the following equations is the most accurate linear model for the scatterplot shown above?

- A) $y = 21.6x + 35$
- B) $y = 21.6x - 35$
- C) $y = -21.6x + 35$
- D) $y = -21.6x - 35$

STOP

If you finish before time is called, you may check your work on this module only. Do not turn to any other module in the test.

CONTINUE

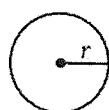
Math**22 QUESTIONS**
(TIME: 35 MIN)**DIRECTIONS**

The questions in this section address a number of important math skills.
Use of a calculator is permitted for all questions.

NOTES

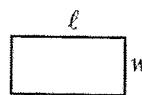
Unless otherwise indicated:

- All variables and expressions represent real numbers.
- Figures provided are drawn to scale.
- All figures lie in a plane.
- The domain of a given function f is the set of all real numbers x for which $f(x)$ is a real number.

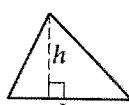
REFERENCE

$$A = \pi r^2$$

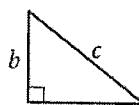
$$C = 2\pi r$$



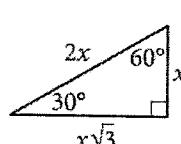
$$A = \ell w$$



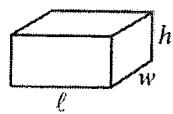
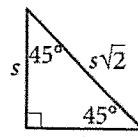
$$A = \frac{1}{2} bh$$



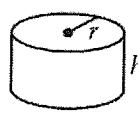
$$c^2 = a^2 + b^2$$



Special Right Triangles



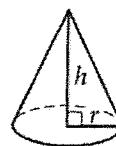
$$V = \ell wh$$



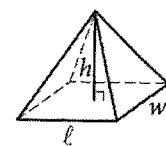
$$V = \pi r^2 h$$



$$V = \frac{4}{3} \pi r^3$$



$$V = \frac{1}{3} \pi r^2 h$$



$$V = \frac{1}{3} \ell wh$$

The number of degrees of arc in a circle is 360.

The number of radians of arc in a circle is 2π .

The sum of the measures in degrees of the angles of a triangle is 180.

For multiple-choice questions, solve each problem, choose the correct answer from the choices provided, and then circle your answer in this book. Circle only one answer for each question. If you change your mind, completely erase the circle. You will not get credit for questions with more than one answer circled, or for questions with no answers circled.

For student-produced response questions, solve each problem and write your answer next to or under the question in the test book as described below.

- Once you've written your answer, circle it clearly. You will not receive credit for anything written outside the circle, or for any questions with more than one circled answer.
- If you find **more than one correct answer**, write and circle only one answer.
- Your answer can be up to 5 characters for a **positive** answer and up to 6 characters (including the negative sign) for a **negative** answer, but no more.
- If your answer is a **fraction** that is too long (over 5 characters for positive, 6 characters for negative), write the decimal equivalent.
- If your answer is a **decimal** that is too long (over 5 characters for positive, 6 characters for negative), truncate it or round at the fourth digit.
- If your answer is a **mixed number** (such as $3\frac{1}{2}$), write it as an improper fraction (7/2) or its decimal equivalent (3.5).
- Don't include **symbols** such as a percent sign, comma, or dollar sign in your circled answer.

$$-2(1 - x) - 3 = ax + 1$$

If the equation above has no solutions, for a constant a , what is the value of a ?

2

For an exponential function f , where k is a constant. If the value of $f(-2)$ is k , which of the following forms of the function f shows the value of k as the coefficient?

- A) $f(x) = 202(2.1)^{x-2}$
- B) $f(x) = 12.5(2.1)^x$
- C) $f(x) = -302(2.1)^{-x}$
- D) $f(x) = 4(2.1)^{x+2}$

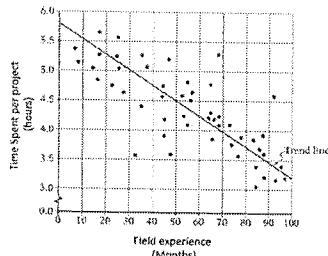
3

If Sally earns k dollars for t hour in her job, which of the following expression represents the amount of money, in dollars, Sally makes for $4t + 1$ hours of work if she earns only hourly pay?

- A) $4k$
- B) $4k + 1$
- C) $4k + t/k$
- D) $4k + k/t$

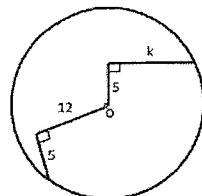
4

TIME SPENT IN HOURS PER PROJECT AND FIELD EXPERIENCE IN MONTHS
IN ABC MANUFACTURING COMPANY



In the scatterplot above, the data represent the time spent, in hours, per project for 50 workers in ABC Company. What fraction of workers could finish one project less than the expected time, in hours, if the workers had at least 80 hours of field experience?

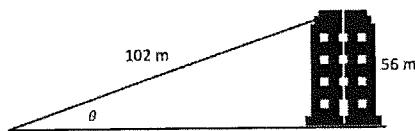
5



Note: Not drawn to scale.
O is the center of the circle

In the circle O above, what is the value of k?

7



The guywire length stretched from the ground to the top of the building is 102 m and the height of the building is 56 m. Which of the following expressions represents the angle of elevation of the guywire from the ground to the top of the building?

- A) $\sin^{-1}\left(\frac{56}{102}\right)$
- B) $\cos^{-1}\left(\frac{56}{102}\right)$
- C) $\tan\left(\frac{56}{102}\right)$
- D) $\sin\left(\frac{56}{102}\right)$

6

$$3x = 4y = 2z = 20$$

In the equation above, what is the value of $15xy^2z$?

- A) 8,000
- B) 15,000
- C) 20,000
- D) 25,000

8

$$2x^2 - (m + 1)x + 2m = 0$$

In the equation above, m is a constant. If the sum of two roots is 4, then what is the product of the roots?

- A) 4
- B) 5
- C) 7
- D) 8

$$y < \frac{2}{3}x + 2$$

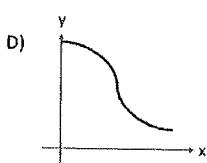
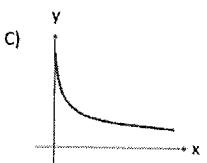
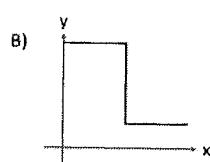
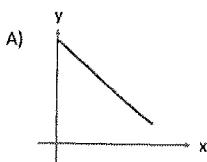
$$y > \frac{2}{3}x - 1$$

In the inequalities shown above, if $(0, a)$ is a solution of the system of inequalities, assuming a is positive integer, what is the value of a ?

- A) 1
- B) 2
- C) 3
- D) 4

10

A person is injected with a certain drug. The amount of drug left in the person's body decreases in half every hour at a constant rate. Which of the following graphs best represents the amount of drug left after a certain time?



11

Jeremiah builds catapult for his physics project. The restriction of the catapult must measure 20 cm in height, with 1.5 cm margin of error. Which absolute inequalities show the possible height of the catapult he can build?

- A) $|20 - x| < 1.5$
- B) $|x - 1.5| < 20$
- C) $|x - 20| > 1.5$
- D) $|x - 1.5| < 20$

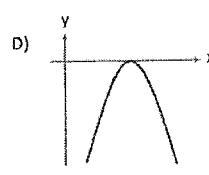
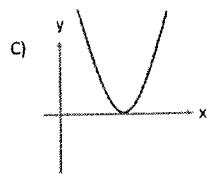
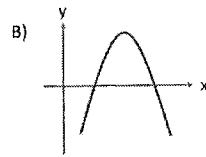
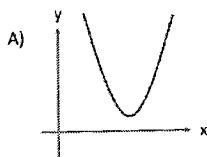
12

An author wants to publish his book. A book publisher informs that the thickness of pages is 0.2 millimeters and both front cover and back cover need to have 3 millimeters thick respectively. Which of the following functions shows the total thickness of the book in millimeter which has x pages?

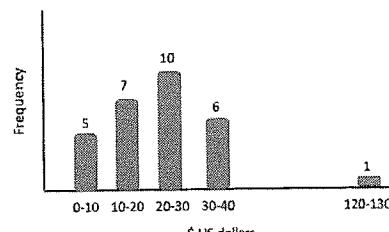
- E) $f(x) = 3 + 0.2x$
- F) $f(x) = 6 + 0.2x$
- G) $f(x) = 3 + 0.4x$
- H) $f(x) = 6 + 0.4x$

13

The function f is defined by $f(x) = -(x - 1)^2 + 1$.
 Which of the following graphs below could be the graph of $y = f(x) - 1$?



15



The graph above shows the frequency distribution of 29 students weekly allowance.

If the student who gets the largest weekly allowance in the data (outlier) is removed from the research, which value could be affected the most?

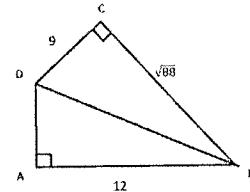
- A) Median
- B) Range
- C) Interquartile Range
- D) Mode

14

A carpenter needs to make 4 wooden dog houses. The length of wood stick required for each dog house is 2.9 ft. if the wood stick is purchased as a single length in feet and sells for \$2 per foot. what is the total cost of the wood stick needs to be purchased for the 4 dog houses?

- A) \$24.00
- B) \$23.20
- C) \$23.00
- D) \$22.90

16



In the figure above, what is the area of triangle ABD?

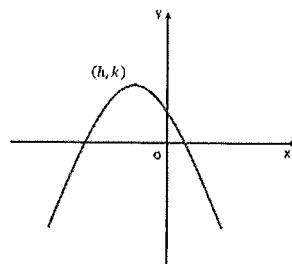
- E) 28
- F) 29
- G) 30
- H) 31

17

Adrian's monthly earning is t dollars. If he spends $\frac{2}{5}t$ dollars for taxes and expenses and saves the rest every month. If this continues at the same rate, how many years will it take him to save \$3600?

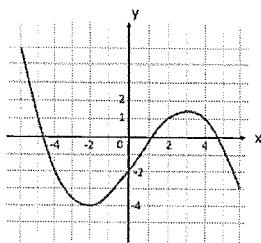
- A) $\frac{6000}{t}$
- B) $\frac{1000}{t}$
- C) $\frac{500}{t}$
- D) $\frac{3600}{t}$

19



The graph of $y = a(x + 3)(x - 1)$ is shown in the XY-plane above, where a is a constant. If the graph passes through $(0, 2)$ and the coordinates of the vertex is (h, k) , what is the value of k ?

18



The figure above shows the complete graph of the function f in the xy -plane. How many values of x exist if $f(x) = f(f(-2))$?

- A) 0
- B) 1
- C) 2
- D) 3

20

During a one-year study, the price of a certain car 10 percent was decreased in the first half year and then increased 10 percent in the second half year. From the beginning of the year to the end of the year, the price of car was

- A) did not change
- B) decreased by 1%
- C) increased by 1%
- D) decreased by 10%

21

$$x^2 + 6x + y^2 - 2y = -1$$

In the circle equation above, what is the circumference of the circle?

- E) π
- F) 3π
- G) 6π
- H) 9π

22

$$\begin{aligned}2x - y &= 1 \\y &= x^2 - 9\end{aligned}$$

The graphs of the system of equations intersects at the points (x, y) in the XY -plane. What is the product of two y values?

- A) -8
- B) 8
- C) -35
- D) 35

STOP

If you finish before time is called, you may check your work on this module only. Do not turn to any other module in the test.