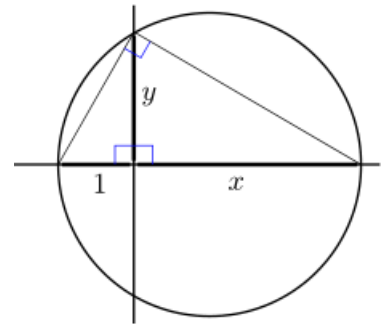


1. On a test Robert got twice as many answers correct as Chris, and three more correct than Jason. Jason got 40% more correct than Chris. How many answers did Jason get correct?

- a) 3
- b) 5
- c) 7
- d) 9
- e) 10

2. In the geometric figure on the right, the diameter of the circle is $1+x$. Determine the length y .

- a) 2
- b) $\frac{x}{1+x}$
- c) $\frac{1+x}{x}$
- d) \sqrt{x}
- e) $\sqrt{x+1}$



3. If $x \triangleleft y$ is defined as $(x + y)^2 - 4xy$, then $5 \triangleleft 6$ is

- a) 1
- b) 11
- c) 30
- d) 121
- e) 241

4. Suppose that a triangle has sides with lengths 8 cm, 15 cm, and 17 cm. Which of the following statements about this triangle is/are necessarily true?

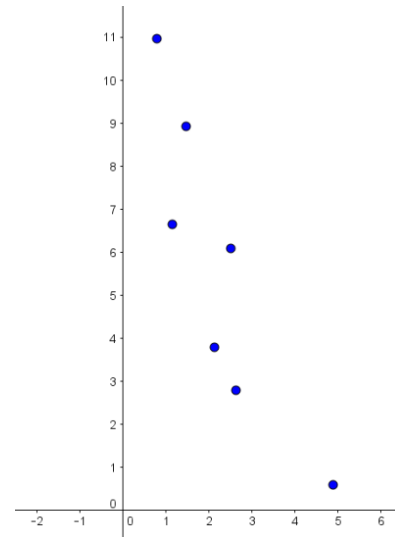
- a) This triangle contains two acute angles.
- b) This triangle contains an obtuse angle.
- c) This triangle contains a right angle.
- d) Statements a and b.
- e) Statements a and c.

5. A fishing boat is initially located at the point (5, 30) on a coordinate grid and a sailboat is initially located at the point (25, 10) on the same coordinate grid. One hour later the fishing boat is located at (40, 100) and the sailboat is located at the point (5, 70). If the paths of the boats on the coordinate grid are linear, at what point on the coordinate grid will the paths of the boats intersect?

- a) (13, 46)
- b) (12, 50)
- c) (12, 40)
- d) (11, 35)
- e) (10, 34)

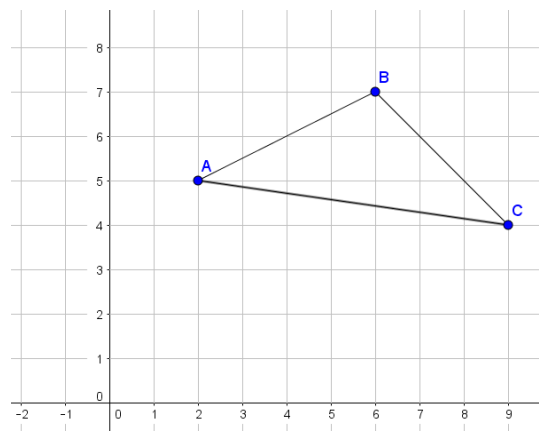
6. Which of the following lines will provide the closest fit to the scatterplot shown to the right?

- a) $y = 3x + 12$
- b) $y = -3x + 12$
- c) $y = -3x - 12$
- d) $y = 3x - 4$
- e) $y = -3x + 4$



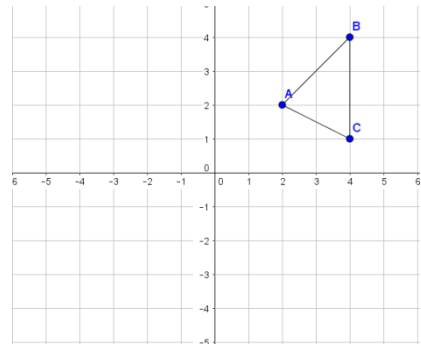
7. Triangle ABC is shown below on a coordinate grid. If we reflect this triangle across the line $y = 2$, what will be the coordinates of the image of point B?

- a) (6, -7)
- b) (-4, -3)
- c) (-4, 7)
- d) (6, -3)
- e) (-6, 7)



8. Triangle ABC is shown below on a coordinate grid. If we rotate this triangle counterclockwise 90 degrees about the origin, what will be the coordinates of the image of point C?

- a) $(-4, -1)$
- b) $(4, -1)$
- c) $(-1, 4)$
- d) $(-4, 1)$
- e) $(-1, -4)$



9. Ms. Miller bought a packet of 15 assorted pepper seeds, and she wants to plant some of them in her garden. The packet says it is a mix of three varieties of bell pepper: green, red, and yellow. There are 5 seeds of each color in a packet. When her three children see the seeds, they ask her to plant an extra seed for each of them because they each want their own pepper plant. The children like to match, so they also ask that their three pepper plants be the same color. They don't care which color it is, just that the three plants are the same.

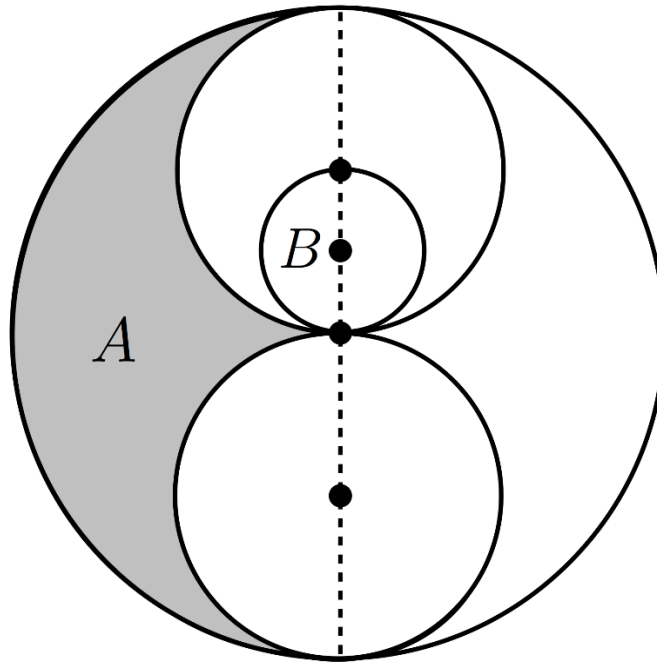
But Ms. Miller can't tell which color is which; the seeds all look alike. She doesn't want to plant too many pepper plants, because she wants to leave room to plant other vegetables. What is the smallest number of seeds she can plant to guarantee three of the seeds are of the same color of pepper?

- a) 6
- b) 7
- c) 9
- d) 11
- e) 13

10. If there are 64 teams in a single elimination soccer competition (so one loss and the team is eliminated), how many games must be played to select the single winner?

- a) 31
- b) 32
- c) 63
- d) 64
- e) 128

11. Consider the image below consisting of 4 circles. The centers have been marked and all lie on a diameter of the large circle. If A is the area of the shaded region, and B is the area of the smallest circle, what is $A \div B$?



- a) 3
- b) π
- c) 4
- d) 5
- e) 2π

12. A sphere has radius 5 ft. How much does the volume of the sphere increase if the radius increases by .1 ft? Round answers to the nearest thousandths place.

- a) 0.004 ft^3
- b) 0.031 ft^3
- c) 3.173 ft^3
- d) 32.048 ft^3
- e) 96.145 ft^3

13. Two spacecraft travel on the same plane in space. One of the craft will rendezvous with the other and bring much needed supplies. The two captains agree to meet at the point (9,15) in the plane. If the supply craft leaves from the coordinates (4,7) and travels in a line toward the rendezvous point, which of the following lines best represents the supply craft's path?

a) $y = \frac{8}{5}x + \frac{3}{5}$

b) $y = \frac{8}{5}x - \frac{3}{5}$

c) $y = \frac{5}{8}x + \frac{75}{8}$

d) $y = \frac{5}{8}x + \frac{9}{2}$

e) $y = \frac{8}{5}x + \frac{75}{8}$

14. If two sides of a triangle are 23 and 35, which could not be the length of the other side?

a) 13

b) 57

c) 60

d) 14

e) 15

15. An airplane leaves an airport traveling at 500 miles per hour along a line for two hours. It then makes a full ninety-degree turn and travels another four hours along a line at 500 miles per hour, after which the control tower at the airport loses contact. How far away, to the nearest mile, from the tower is the plane when contact was lost?

a) 2236 miles

b) 4 miles

c) 2000 miles

d) 707 miles

e) 3000 miles

16. How many non-congruent right triangles are there if all the side lengths have integer values and one of the legs is 12 units long?

- a) None
- b) One
- c) Two
- d) Three
- e) More than three

17. John's lawnmower mows a strip 3 feet wide while traveling 250 feet per minute. What is the least amount of time (in minutes) that it would take him to mow a yard that is 300 feet by 400 feet?

- a) 240
- b) 120
- c) 60
- d) 300
- e) 160

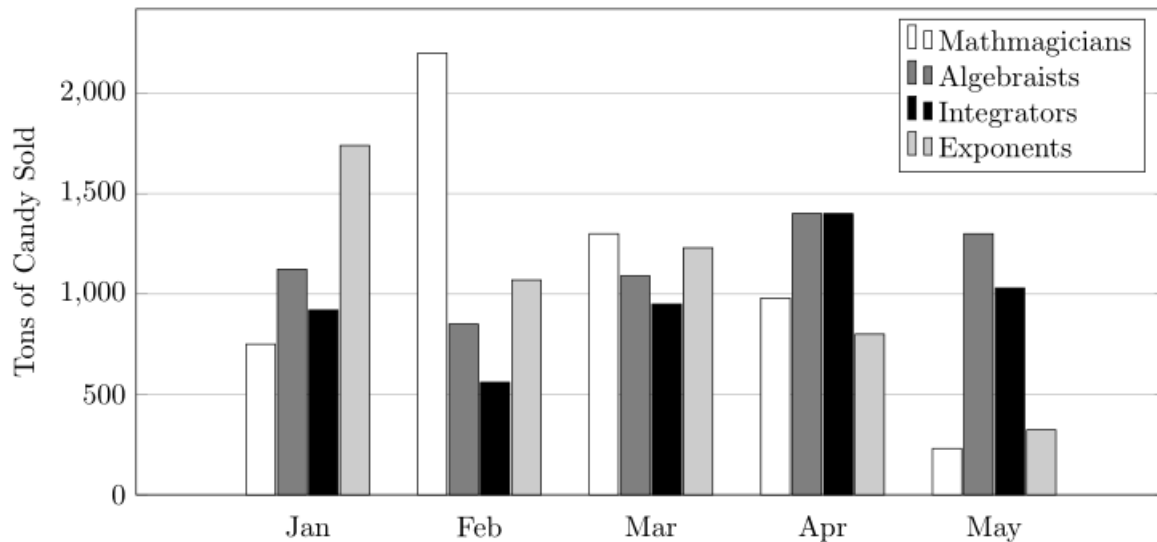
18. If the measures of the **angles** in a triangle are in a 1:2:3 ratio, what kind of triangle is it?

- a) acute
- b) obtuse
- c) right
- d) isosceles
- e) equilateral

19. A square has sides measuring 12 units. If this square is rotated 90 degrees clockwise, translated 30 units to the left, and then dilated by a factor of two, the area of the resulting square will be

- a) 144 square units
- b) 192 square units
- c) 288 square units
- d) 576 square units
- e) 4096 square units

20. Walmart sells four types of mathematical gum: Mathmagicians, Algebraists, Integrators and Exponents. The graph below shows the number of tons of each that was sold during the first five months of 2016. Which type of gum did they sell the most of during March and April (combined)?



- a) Mathmagicians
- b) Algebraists
- c) Integrators
- d) Exponents
- e) There is not enough information provided to answer this question.

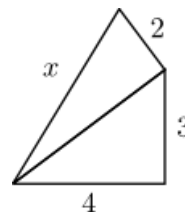
21. The length of the trail from the bottom to the top of Mt. Martin is six miles. Sally goes up the trail at two miles an hour, stays an hour on top for lunch, then comes down at three miles an hour. What time must Sally start her hike in the morning to be home at 3 pm?

- a) 8 am
- b) 9 am
- c) 10 am
- d) 11 am
- e) noon

22. Of the numbers listed below, which is the largest?

- a) $1000^{1000+1000}$
- b) $1000^{1000 \cdot 1000}$
- c) $1000 \cdot 1000^{1000}$
- d) $(1000 + 1000)^{1000}$
- e) $1000^{1000} + 1000^{1000}$

23. In the geometric figure on the right, the two triangles are right triangles. Determine the length x .



- a) $\sqrt{29}$
- b) $2 + \sqrt{5}$
- c) 7
- d) $\sqrt{41}$
- e) 5

24. Which of the following statements is true?

- a) $8^5 \times 8^{-2} = \frac{1}{64}$
- b) $4^{-5} \times 4^2 = \frac{1}{64}$
- c) $5^3 \times 5^{-2} = \frac{1}{25}$
- d) $9^{-4} \times 9^5 = \frac{1}{9}$
- e) $10^7 \times 10^{-3} = \frac{1}{100}$

25. Let $n = 3a + 2b - 7$. What happens to the value of n if the value of a increases by 2 and the value of b decreases by 1?

- a) It is unchanged.
- b) It decreases by 1.
- c) It increases by 4.
- d) It decreases by 4.
- e) It decreases by 2.

26. A tower of blocks is built on a desk. The table shows the height, h , in inches from the floor, of the top of the tower at various stages of construction. The stages are measured in the number, n , of blocks in the tower. Which of the items below shows a correct equation modeling this situation?

Number of blocks, n	3	6	9	15
Height of top of tower above floor in inches, h	29.375	30.125	30.875	32.375

- a) $(h - 30.125) = \frac{1}{30.125}(n - 6)$
- b) $h = \frac{1}{30.125}n + 29.9258$
- c) $(h - 30.875) = \frac{1}{4}(n - 3)$
- d) $(h - 30.875) = \frac{1}{4}(n - 9)$
- e) $(h - 30.125) = \frac{1}{30.125}n - 6$

27. The state of Colorado extends 623 kilometers east to west and 444 kilometers north to south. Assuming that the shape of the state is a rectangle, which of the following values best expresses the area of the state of Colorado?

- a) 1×10^4 square miles
- b) 1,067 kilometers
- c) 2134 kilometers
- d) 2.7×10^4 square kilometers
- e) 2.8×10^5 square kilometers

28. Suppose three fair 6-sided dice are rolled. What is the probability that the sum is at least 17?

- a) $\frac{1}{54}$
- b) $\frac{1}{108}$
- c) $\frac{1}{9}$
- d) $\frac{2}{17}$
- e) $\frac{1}{8}$

29. Consider the rational number $x = 2.311111\dots$, where the 1s repeat forever. If we express x as a ratio of two integers, what is the smallest denominator we can use?

- a) 9
- b) 99
- c) 90
- d) 45
- e) x cannot be expressed as a ratio of two integers.

30. A straight highway runs 100 miles east from Westtown to Dawnville. Twenty miles from Westtown, the highway runs through Centralia. At 8:00 am, Phil departs Westtown toward Dawnville and travels at a constant 12 miles per hour on a bicycle. Also at 8:00 am, Charlotte leaves Centralia on a bicycle and travels toward Dawnville at a constant 9 miles per hour. Once reaching Dawnville, each of the cyclists stops and rests for a long time. In the following diagrams, the horizontal axis indicates time in hours since 8:00 am. The vertical axis indicates distance, in miles, east of Westtown. Which graph correctly depicts Phil's position (solid arrow) and Charlotte's position (dashed arrow)?

