1. For what value of x is the point $(x, -1)$ a solution of the equation $y = -\frac{3}{2}x - 3$?

   A. $x = -\frac{1}{3}$

   B. $x = -2\frac{1}{4}$

   C. $x = -1\frac{1}{3}$

   D. $x = -\frac{2}{3}$

   E. $x = -\frac{1}{2}$

2. Evaluate the expression $\dfrac{0.25 \times \frac{1}{0.125} \times \left(\frac{1}{4}\right)^{0.5}}{\frac{5}{4}}$.

   A. 3.2

   B. 1.2

   C. 2.3

   D. 7.2

   E. 0.8

3. Which of the following is a Pythagorean Triple? That is, which set of numbers could be the lengths, in a given unit, of the sides of a right triangle?

   A. 105, 208, 233

   B. 105, 208, 235

   C. 104, 153, 186

   D. 103, 153, 188

   E. 103, 153, 256

4. An urn contains 100 balls which are identical except for color. Fifty of the balls are red, and fifty of the balls are green. Without looking, Susan removes a ball from the urn, looks to record its color and returns the ball to the urn. Susan shakes the urn, without looking removes a ball a second time, looks to record its color and returns the ball to the urn. Susan shakes the urn, without looking removes a ball a third time, and looks to record its color. Find the theoretical probability that Susan removed a green ball at most twice during this process.

   A. $\frac{2}{3}$

   B. $\frac{7}{8}$

   C. $\frac{1}{3}$

   D. $\frac{3}{8}$

   E. $\frac{1}{2}$

5. Solve the equation $3^{2(x-1)} - 8(3^{x-2}) = 1$

    A. $x = 9$

    B. $x = 1$

    C. $x = 2$

    D. $x = -1$

    E. $x = 3$

6. Identify the pair of equations whose solutions are represented by the graph in Figure 1.

    A. $2y = x + 9; \quad -y = x - 6$

    B. $y = 3x - 5; \quad -\frac{1}{5}y = \frac{2}{5}x - 1$

    C. $3y = 2x - 1; \quad y = x - 3$

    D. $-y = -2x + 3; \quad 3y = x + 1$

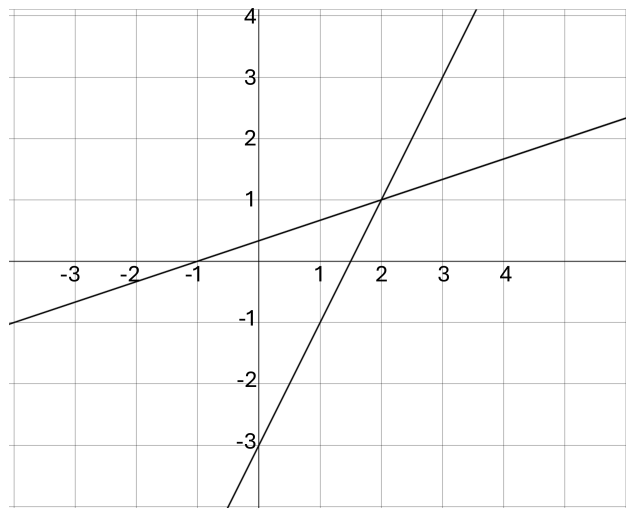   E. $-2y = x - 9; \quad y = -x + 6$

Figure 1: Linear equations

7. If it takes five days for a worker to clear a portion of farmland, how many days would it take twenty-four such workers to clear fifty such portions of farmland? Assume that all workers work at the same rate. Round to the nearest hundredth of a day.

    A. 14.50

    B. 10.75

    C. 11.05

    D. 11.50

    E. 10.42

8. A binary operation $*$ is defined on a and b as follows: $a * b = \frac{2a-4ab^4}{6b+a^3} - 5$.
   Evaluate $(-3) * 4$.

   A. -1,294
   B. 650
   C. 1,655
   D. -2,428
   E. -1,027

9. An investigator conducted research to determine if the wealth of business owners in Asia depends on their ages. The scatter plot in Figure 2 represents the ages and wealth of some selected business owners in Asia. What can you say about the relationship between wealth and age in this data set?
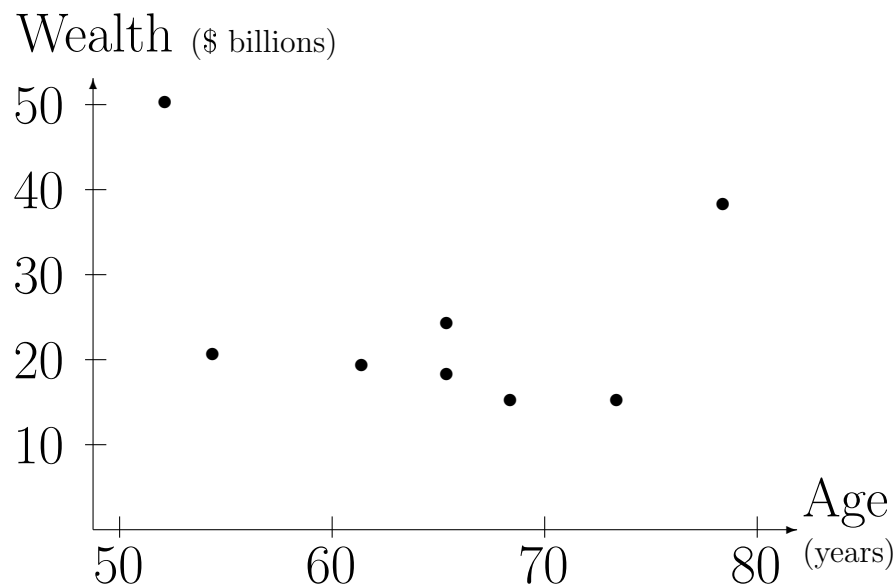

Figure 2: Scatter plot

   A. There is no relationship.
   B. There is a strong positive relationship.
   C. There is a weak negative relationship.
   D. There is a strong negative relationship.
   E. There is a weak positive relationship.

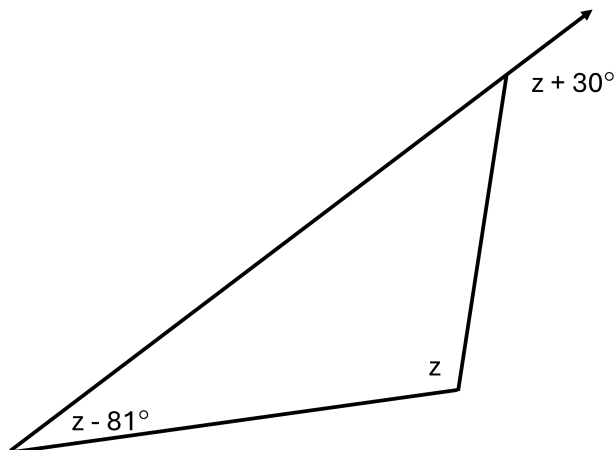10. The triangle in Figure 3 has an exterior angle of size $z + 30°$. Find the value of z.

Figure 3: Triangle with exterior angle

    A. 68°

    B. 125°

    C. 111°

    D. 77°

    E. 82°

11. Which of the following points lies outside the line defined by the equation $y = 5x - 7$?

    A. (12, -17)

    B. (3, 8)

    C. (4, 13)

    D. (0, -7)

    E. (1, -2)

12. Amy has a piece of wire shaped as a circle with radius 49 cm. Amy wants to shape the wire as a square. Assume that Amy uses all the wire with no waste. Calculate the length of the diagonal of the resulting square to the nearest whole number.

    A. 122 cm

    B. 109 cm

    C. 164 cm

    D. 77 cm

    E. 112 cm

13. The faces of a cube are labeled 1, 2, 3, 4, 5, 6, and each face is equally likely to appear when the cube is rolled. A coin has two sides, heads and tails, and each side is equally likely to appear when the coin is flipped. If Katie simultaneously rolls two such cubes and flips one such coin, find the probability of obtaining two even numbers and a head.

    A. $\frac{1}{4}$
    B. $\frac{2}{5}$
    C. $\frac{5}{7}$
    D. $\frac{1}{3}$
    E. $\frac{1}{8}$

14. A standard deck of cards contains 4 aces. Cole draws three cards from a shuffled standard 52-card deck one after the other without replacement. What is the probability that the third draw is an ace given that the first two draws were not aces? Round your answer to the nearest hundredth.

    A. 0.08
    B. 0.15
    C. 0.03
    D. 0.02
    E. 0.25

15. The sum of three successive even numbers is 204. Find the 5th odd number after the greatest of these three even numbers.

    A. 77
    B. 79
    C. 81
    D. 83
    E. 85

16. Adam wishes to arrange 6 different books left to right on a single shelf. All six books will be oriented in the same direction, right-side-up, with spines vertical and facing out. In how many different orders can Adam arrange the 6 books?

    A. 800 ways

    B. 1,050 ways

    C. 260 ways

    D. 720 ways

    E. 360 ways

17. An *arithmetic sequence* is a sequence of numbers in which the difference between each term and the one before it is a constant. As examples,
    $1, 3, 5, 7, \ldots$ is an arithmetic sequence with a common difference of 2;
    $8, 8.5, 9, 9.5, \ldots$ is an arithmetic sequence with a common difference of 0.5; and
    $9, 23/3, 19/3, 5, \ldots$ is an arithmetic sequence with a common differencde of $-4/3$.

    If 3, x, y, 8 are sequential terms in an arithmetic sequence, find the sum $3 + x + y + 8$.

    A. 66

    B. 22

    C. 11

    D. 36

    E. 44

18. A piece of paper in the shape of a circular sector with radius 2 cm and a central angle of 60° is folded to form a cone. Assume no overlap at the seam. Find the volume of this cone.

    A. $\frac{\sqrt{41}\,\pi}{81}$ cm^3

    B. $\frac{\sqrt{41}\,\pi}{9}$ cm^3

    C. $\frac{\sqrt{35}\,\pi}{81}$ cm^3

    D. $\frac{\sqrt{43}\,\pi}{18}$ cm^3

    E. $\frac{\sqrt{35}\,\pi}{9}$ cm^3

19. The points $P(3, 8)$ and $Q(5, 18)$ lie on a straight line. Find the coordinates of the midpoint of the line segment connecting P with the midpoint of the line segment $\overline{PQ}$.

    A. (6.5, 11.5)

    B. (7, 15)

    C. (3.5, 10.5)

    D. (5.5, 12.5)

    E. (4, 13)

20. Johannes and Lucas are buying pencils and notebooks at the same store at the same time. Johannes buys 5 pencils and 2 notebooks for $25. Lucas buys 1 pencil and 6 notebooks for $12. There is no sales tax involved. What is the cost of one pencil and one notebook?

    A. A pencil costs $4.25, and a notebook costs $1.50.
    B. A pencil costs $4.50, and a notebook costs $1.25.
    C. A pencil costs $5.00, and a notebook costs $3.50.
    D. A pencil costs $1.25, and a notebook costs $4.50.
    E. A pencil costs $3.50, and a notebook costs $5.00.

21. Imagine the line segment connecting the bottom, left, front corner to the opposite (top, right, back) corner of the rectangular prism shown in Figure 4. Calculate the length of this segment to the nearest whole number.
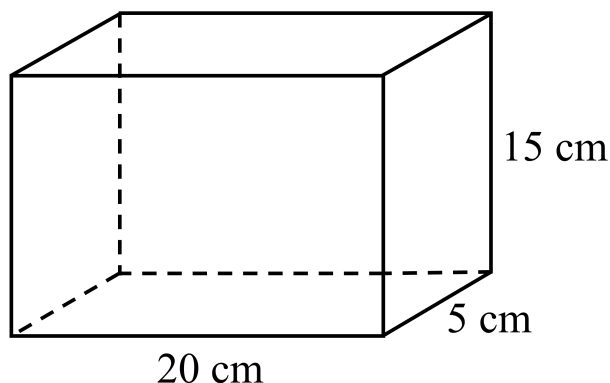

Figure 4: Rectangular Prism

    A. 27 cm
    B. 31 cm
    C. 17 cm
    D. 25 cm
    E. 24 cm

22. Two non-vertical lines in the xy-plane are perpendicular if the product of their slopes is -1. Write the equation of a line which passes through the point (-7,12) and is perpendicular to the line $y = -\frac{1}{2}x + 3$.

    A. $y = 2x + 26$
    B. $y = -2x - 14$
    C. $y = \frac{3}{4}x - 15$
    D. $y = -2x - 2$
    E. $y = 2x + 2$

23. Emily deposits \$500 in a savings account that pays a simple interest rate of 4% per year. After 2 years, she deposits an additional \$300 into the account. She leaves the money in the account for 1 more year at the same interest rate. To the nearest dollar, what is the total amount in Emily's account at the end of these 3 years?

    A. \$889

    B. \$872

    C. \$874

    D. \$906

    E. \$925

24. Each of the variables A through F represents exactly one of the digits 0 through 5 in the equations below. A variable has the same value everywhere it occurs. Which values of the variables make all five equations true?

$A + A = F * A$
$C + C + C = C^2$
$D * C = C$
$F + B = F$
$A - (D + E) = B$

    A. A=1, B=3, C=4, D=5, E=0, F=2

    B. A=5, B=0, C=3, D=4, E=2, F=1

    C. A=4, B=3, C=2, D=1, E=5, F=0

    D. A=5, B=0, C=3, D=1, E=4, F=2

    E. A=4, B=5, C=0, D=1, E=0, F=3

25. $(6789)^2 = 6789 \times 6789$; $(6789)^3 = 6789 \times 6789 \times 6789$; and so forth. When $(6789)^{23}$ is completely multiplied out, what is the digit in the ones place of the resulting number?

    A. 1

    B. 3

    C. 6

    D. 8

    E. 9

26. The arithmetic mean of the numbers 3, x, y, 15, 19 and 21 is 12. What is the sum $x+y$?

    A. $x + y = 9$
    B. $x + y = 12$
    C. $x + y = 13$
    D. $x + y = 14$
    E. $x + y = 17$

27. Order the fractions $\frac{2}{3}, \frac{5}{8}, \frac{3}{4}, \frac{7}{12}, \frac{1}{2}, \frac{9}{10}$ from the smallest to the largest.

    A. $\frac{9}{10}, \frac{7}{12}, \frac{5}{8}, \frac{1}{2}, \frac{2}{3}, \frac{3}{4}$
    B. $\frac{3}{4}, \frac{2}{3}, \frac{1}{2}, \frac{5}{8}, \frac{7}{12} \frac{9}{10}$
    C. $\frac{5}{8}, \frac{1}{2}, \frac{7}{12}, \frac{2}{3}, \frac{3}{4}, \frac{9}{10}$
    D. $\frac{7}{12}, \frac{5}{8}, \frac{3}{4}, \frac{1}{2}, \frac{9}{10}, \frac{2}{3}$
    E. $\frac{1}{2}, \frac{7}{12}, \frac{5}{8}, \frac{2}{3}, \frac{3}{4}, \frac{9}{10}$

28. In Figure 5, lines n and m are cut by transversals p and q. What value of x would make lines n and m parallel?
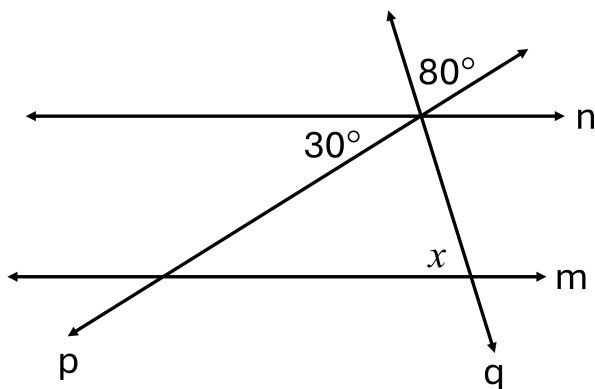

Figure 5: Lines & transversals

    A. 50°
    B. 110°
    C. 80°
    D. 70°
    E. 115°

29. Which of the following reasons could be used to prove that a parallelogram is a rhombus?

    A. Sum of the measures of the interior angles is 180°.

    B. Diagonals are congruent.

    C. Opposite angles are congruent.

    D. Opposite sides are parallel.

    E. Diagonals are perpendicular.

30. For what value of x is $x\sqrt{5} = \sqrt{80}$?

    A. $x = 4$

    B. $x = 5$

    C. $x = 6$

    D. $x = 12$

    E. $x = 16$