Answers and Explanations

PRACTICE TEST 3

1. **C**
   Express each side as a power of the same base.

$$\begin{aligned} 2^{3x-2} &= 16 \\ 2^{3x-2} &= 2^4 \\ 3x-2 &= 4 \\ 3x &= 6 \\ x &= 2 \end{aligned}$$

2. **B**
   Use substitution.

$$\begin{aligned} 4a^2 - 4b &= 5 \\ 4\left(\frac{1}{2}\right)^2 - 4b &= 5 \\ 4\left(\frac{1}{4}\right) - 4b &= 5 \\ 1 - 4b &= 5 \\ -4b &= 4 \\ b &= -1 \end{aligned}$$

3. **B**
   You don't have to solve for the value of *x* to answer this question because the denominator on the left side of the equation is 3 times (*x* + 4). Noticing this can save you time for other questions—a good strategy in the early questions.

$$\begin{aligned} \frac{2}{3x+12} &= \frac{2}{3} \\ \frac{2}{3(x+4)} &= \frac{2}{3} \end{aligned}$$

Since 3(1) = 3, $x + 4 = 1$.

4. **E**

First isolate one of the variables:

$$\begin{aligned} y + x + 1 &= 0 \\ y &= -x - 1 \end{aligned}$$

Then use substitution:

$$\begin{aligned} 2y - 4x &= 4 \\ 2(-x - 1) - 4x &= 4 \\ -2x - 2 - 4x &= 4 \\ -6x - 2 &= 4 \\ -6x &= 6 \\ x &= -1 \end{aligned}$$

Plug $x = -1$ back into one of the original equations to find y:

$$\begin{aligned} y + x + 1 &= 0 \\ y - 1 + 1 &= 0 \\ y &= 0 \end{aligned}$$

That's (E).

5. **D**

If y is the number of minutes it takes to type 500 words, then set up the following proportion:

$$\begin{aligned} \frac{x \text{ words}}{1 \text{ minute}} &= \frac{500 \text{ words}}{y \text{ minutes}} \\ xy &= 500 \\ y &= \frac{500}{x} \end{aligned}$$

6. **A**

Mary spends 40% of her earnings on rent.

If x = the amount earned, $x(40\%) = 800$

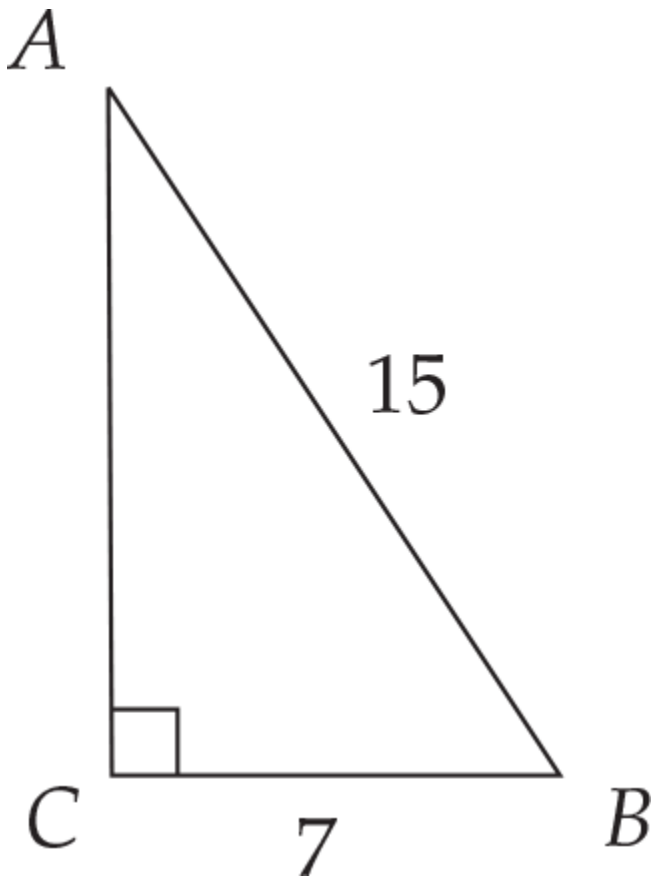
$$\begin{aligned} 0.4x &= 800 \\ x &= \$2,000 \text{ monthly earnings} \end{aligned}$$

Mary has 60% of her earnings left after spending 40% on rent. She spends 10% on entertainment which is 10% × 60% = 6% on entertainment.

$$6\% \text{ of } \$2{,}000 = 0.06 \times 2{,}000 = \$120$$

7. **C**

Make a diagram. Use cosine to find $m\angle B$. (Remember: SOHCAHTOA)



$$\begin{aligned} \cos\angle B &= \frac{\text{adjacent}}{\text{hypotenuse}} \\ \cos\angle B &= \frac{7}{15} \\ m\angle B &= 62^\circ \end{aligned}$$

8. **A**

First, rewrite the left side of the equation as a single fraction by getting a common denominator.

$$\begin{aligned}
\frac{x-3}{6} - \frac{x+1}{4} &= 3 \\
\frac{2(x-3)}{12} - \frac{3(x+1)}{12} &= 3 \\
\frac{2x-6-3x-3}{12} &= 3 \\
\frac{-x-9}{12} &= 3
\end{aligned}$$

Multiplying both sides by 12, you get

$$\begin{aligned}
-x-9 &= 36 \\
-x &= 45 \\
x &= -45
\end{aligned}$$

9. **D**
   Since $g(x) = f(5x)$, $g(2) = f(5(2)) = f(10)$.

   Since $f(x) = x + 3$, $f(10) = 10 + 3 = 13$.

10. **D**
    For any equation in the form $y = mx + b$, m = slope and b = y-intercept. For the line to have the same y-intercept as $y = 3x + 1$, the y-intercept must be 1. Perpendicular lines have slopes that are negative reciprocals of each other.

    The negative reciprocal of $\frac{1}{4}$ is −4.

11. **D**
    The reflection of a point or figure is the mirror image of that point or figure. When point B is reflected over the line $y = 3$, the x-coordinate will not change. Point B is 4 units below the line $y = 3$, so it will become 4 units above the line.

12. **E**
    This is the number of permutations of 9 things taken 9 at a time.

    $${}_9P_9 = 9! = 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 362{,}880$$

13. **C**
    Distance = rate × time.

    If they traveled at a rate of 55 m/hr: d = 55 m/hr × 13 hrs = 715 miles.

Now we know they traveled 715 miles. If they traveled at a rate of 65 m/hr

$$715 = 65 \text{ m/hr} \times x \text{ hours}$$
$$x = 11 \text{ hours}$$

Finally, 13 hours − 11 hours = 2 hours of time saved.

14. **E**

(A) is always even because two odd integers added together always produce an even integer. (B) is always even because the sum of 5 times an odd number and 3 times an odd number must be even. (C) is not an integer unless *x* = a whole multiple of *y*, so it is not *always* an odd integer. (D) is always even because the difference of two odd integers must be an even number. (E), however, is always odd because the product of two odd integers is odd.

Note: Another way to solve this problem is to pick odd numbers such as 3 and 5 for *x* and *y*.

15. **A**

Cut the circle into 4 equal slices. One of those slices will include the shaded region and a right triangle formed by two radii and the chord. To find the area of the shaded region, subtract the area of the triangle from the area of one-fourth of the circle.

Area of one-fourth of a circle =

$$\frac{1}{4}\pi r^2 = \frac{1}{4}(36)\pi = 9\pi.$$

Area of the triangle =

$$\frac{1}{2}bh = \frac{1}{2}(6)(6) = 18.$$

Area of the shaded region = 9π − 18 ≈ 10.3.

16. **B**

If *x* varies directly as *y*, $\frac{x}{y} = k.$

$$\frac{6}{5} = k$$
$$\frac{6}{5} = \frac{x}{2}$$
$$\frac{12}{5} = x$$
$$x = 2.4$$

17. **C**

$$||-5| - 16 + |-1|| = |5 - 16 + 1| = |-10| = 10.$$

18. **C**

Since Rob rented the minivan for 3 days, he will pay 3($60) = $180.00 plus 0.25 times the number of miles he drove it.

Let m = the number of miles driven. Then 206 = 180 + 0.25 m, 26 = 0.25 m, and m = 104 miles.

19. **C**

$$f(2) = 3(2)^{-2} = 3\left[\frac{1}{2}\right]^2 = 3\left[\frac{1}{4}\right] = \frac{3}{4}.$$

20. **A**

$$\begin{aligned} 3i^2 + i^3 - i^4 &= 3i^2 + i^2 \times i - i^2 \times i^2 \\ &= 3(-1) + (-1)i - (-1)(- \\ &= -3 - i - 1 \\ &= -4 - i \end{aligned}$$

Alternatively, you can factor out i^2 from the equation to get i^2 $(3 + i - i^2)$. Next substitute −1 for i^2 in the new equation: $-1(3 + i - (-1)) = -1(3 + i + 1) = -1(4 + i)$. Then distribute −1: $-4 - i$.

21. **B**

$$\begin{aligned} 6 \ \& \ d = \frac{6}{4} - \frac{d+1}{5} &= 1.7 \\ \frac{3}{2} - \frac{d+1}{5} &= 1.7 \end{aligned}$$

Get a common denominator on the left side:

$$\frac{15}{10} - \frac{2(d+1)}{10} = 1.7.$$

$$\frac{15 - 2d - 2}{10} = 1.7$$

$$\frac{13 - 2d}{10} = \frac{1.7}{1}$$

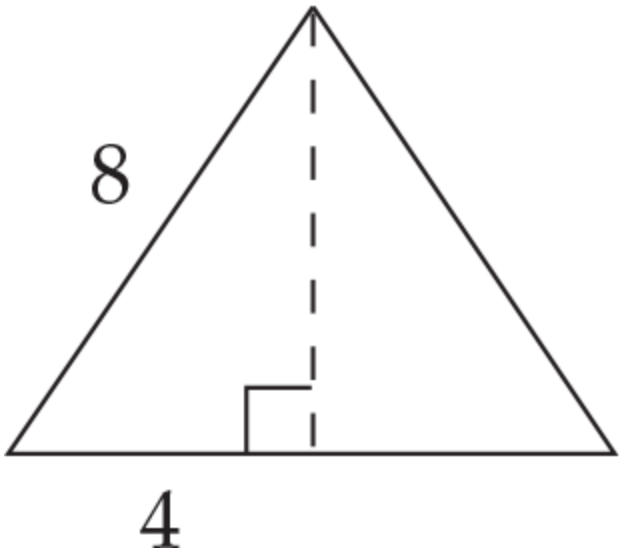
Cross multiply: $13 - 2d = 17$, so $-2d = 4$, and $d = -2$.

22. **E**

Use the Pythagorean theorem:

$$\begin{aligned} 8^2 &= 4^2 + b^2 \\ 64 &= 16 + b^2 \\ 48 &= b^2 \\ \sqrt{48} &= b \\ b &\approx 6.93 \end{aligned}$$

Alternatively, draw an equilateral triangle including the altitude. Two congruent 30–60–90 triangles are formed. The sides in a 30–60–90 are in a ratio of $1 : \sqrt{3} : 2.$

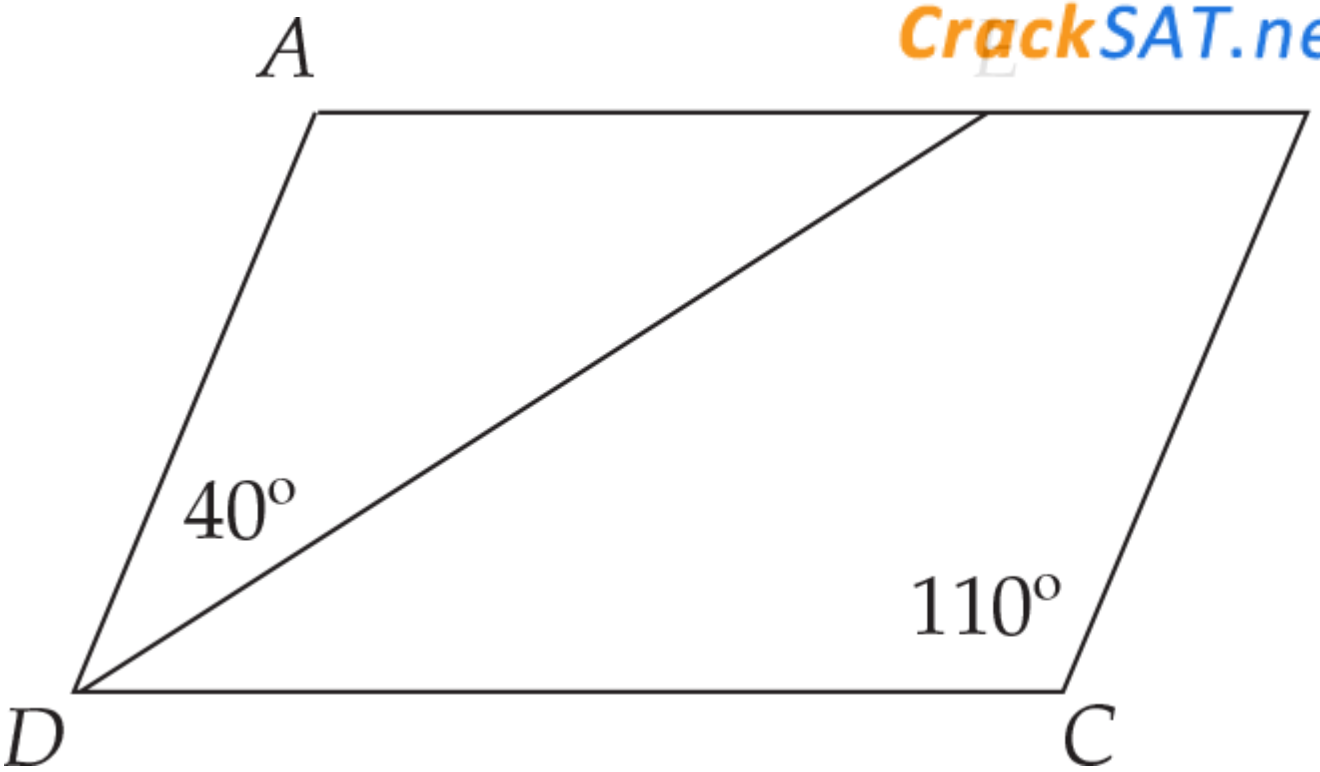


$$4 : 4\sqrt{3} : 8$$
$$4\sqrt{3} \approx 6.93$$

23. **D**

The expression $6 + (x - 2)^2$ is at its minimum when $(x - 2)^2$ is at its minimum value. Since the expression is squared, its minimum is zero. $(x - 2)^2 = 0$ when $x = 2$.

24. **E**



If $m\angle C = 110°$, then the $m\angle A = 110°$ since opposite angles of a parallelogram are equal. Since the three angles in a triangle add up to 180°, $m\angle AED = 30°$. $\angle AED$ and $\angle BED$ are supplementary, so $m\angle BED = 150°$.

25. **C**

The first digit can only be the number 4. Therefore, there is only one option for this digit. There are 4 digits left to choose from for the second digit and 3 digits to choose for the third. Multiply to get 12, which is the number of 3-digit codes that can be formed using each digit only once.

Alternatively, the first digit has already been determined, so look at all of the options for the last two digits: 23, 25, 26, 32, 35, 36, 52, 53, 56, 62, 63, or 65.

26. **A**

Use the trigonometric identity $sin^2\theta + cos^2\theta = 1$.

$$\sqrt{\frac{9sin^2\theta + 9cos^2\theta}{4}} = \sqrt{\frac{9(sin^2\theta + cos^2}{4}}$$

$$\sqrt{\frac{9(1)}{4}} = \sqrt{\frac{9}{4}} = \frac{3}{2} = 1.5$$

27. **A**

When two events are independent, the probability they will both occur is the product of each of their probabilities.

0.2 (0.9) = 0.18 = 18%

28. **E**

This answer can be found by finding both roots and adding them together.

$$\begin{aligned} x^2 - 4x - 12 &= 0 \\ (x-6)(x+2) &= 0 \\ x - 6 &= 0 \text{ or } x + 2 = 0 \\ x &= 6 \text{ or } x = -2 \\ 6 + (-2) &= 4 \end{aligned}$$

29. **C**

Let P = the number of employees at the beginning of 2003. By the end of 2003, the number of employees increases by 18% of P or $0.18P$, so the number becomes $P + 0.18P = 1.18P$.

At the beginning of 2004, the number of employees is represented by $1.18P$. By the end of 2004, the number of employees increases by 26% of $1.18P$, so the number becomes

$$1.18P + 0.26(1.18P) \approx 1.18P + 0.31P = 1.49P.$$

Since $1.49P = P + 0.49P$, the increase over the two-year period is approximately 49%.

30. **C**

Set up a proportion.

$$\begin{aligned} \frac{2 \text{ tons}}{1 \text{ minute}} &= \frac{x \text{ tons}}{3 \text{ hours}} \\ \frac{2 \text{ tons}}{1 \text{ minute}} &= \frac{x \text{ tons}}{180 \text{ minutes}} \\ 1x &= 2 \times 180 \\ x &= 360 \end{aligned}$$

31. **E**

$$\begin{aligned} \text{slope} &= \frac{y_2 - y_1}{x_2 - x_1} \\ \frac{1}{5} &= \frac{y-1}{1+4} \\ \frac{1}{5} &= \frac{y-1}{5} \end{aligned}$$

Set the numerators equal since the denominators are equal.

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

32. **A**

Since the mean of a set of 5 numbers is 90, the sum of those numbers is 5 × 90 = 450. When one number is removed, the mean of the set of the 4 remaining numbers is 92. The sum of those numbers is 4 × 92 = 368. Then 450 − 368 = 82, so 82 must have been the number that was removed.

33. **A**

$$\text{Mean (average)} = \frac{6+7+11+6+8}{5} = \frac{3}{}$$

Median = 7. (Be sure to place the numbers in order before selecting the middle number.)

Mode = 6. (Occurs the most often in the set.)

(A) is the only statement that is true; mean > mode.

34. **C**

$$\text{Mean (average)} = \frac{6+7+8+8+8+10}{8}$$

Out of eight numbers, five are less than the mean of 8.5.

35. **A**

$$\begin{aligned} 3(x+5)-(x+2) &= 2x-3x+4 \\ 3x+15-x-2 &= -x+4 \\ 2x+13 &= -x+4 \\ 3x &= -9 \\ x &= -3 \end{aligned}$$

36. **B**

$$\frac{5}{\left(\frac{1}{x^2}\right)} = 5 \div \left(\frac{1}{x^2}\right) = 5 \times x^2 = 5x^2$$

37. **D**

It helps to put parentheses around $x + y$. Then use FOIL.

$$[(x+y)+3][(x+y)+3] =$$
$$(x+y)^2 + 3(x+y) + 3(x+y) + 9 =$$
$$(x+y)^2 + 6(x+y) + 9$$

38. **D**

Area of the square $= \frac{3}{4}$ (Area of the parallelogram).

Area of the parallelogram $= \frac{1}{3}$ (Area of the trapezoid).

Using substitution, Area of the square $= \frac{3}{4} \times \frac{1}{3}$ (Area of the trapezoid).

Area of the square $= \frac{1}{4}$ (Area of the trapezoid). Thus, $125 = \frac{1}{4}$ (Area of the trapezoid). Area of the trapezoid = 4 × 125 = 500.

39. **B**

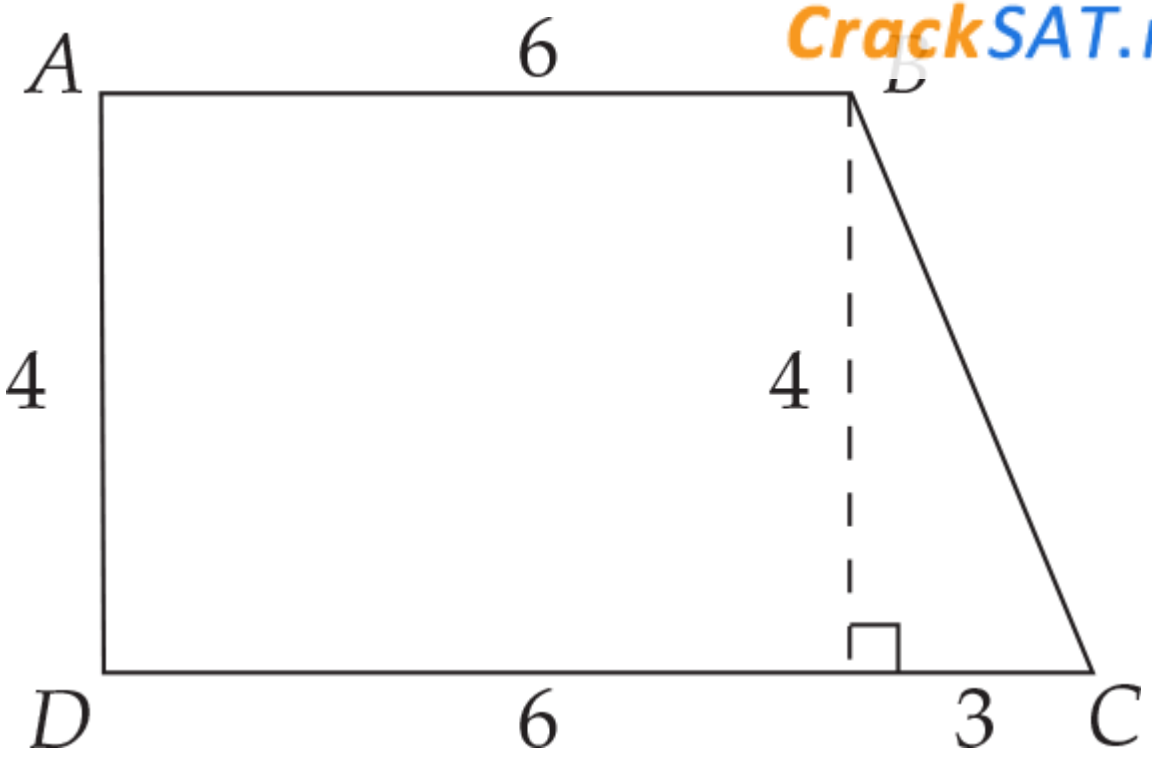
Find the circumference first in order to find the radius.

Set up a proportion.

$$\begin{aligned} \frac{50}{360} &= \frac{5\pi}{C} \\ 50C &= 360(5\pi) \\ C &= 36\pi \\ C &= \pi d \\ d &= 36 \\ r &= 18 \\ A = \pi r^2 = \pi(18)^2 &= 324\pi \end{aligned}$$

40. **C**

Draw the altitude from point *B*. The sides of the right triangle form a 3-4-5 Pythagorean triple. *BC* = 5.



41. **D**

The square root of the cube root of *x* can be expressed as

$$\sqrt{\sqrt[3]{x}} = x^{\frac{1}{3}\left(\frac{1}{2}\right)} = x^{\frac{1}{6}}.$$

$$\begin{aligned} x^{\frac{1}{6}} &= 3 \\ x = 3^6 &= 729 \end{aligned}$$

42. **C**

The point where the horizontal line and the parabola intersect must be the vertex of the parabola. In order to find the point of intersection, set the equations equal to each other.

$$\begin{aligned} -1 &= x^2 - 10x + 24 \\ 0 &= x^2 - 10x + 25 \\ 0 &= (x-5)(x-5) \\ x &= 5 \end{aligned}$$

Since $x = 5$ and the vertex is on the line $y = -1$, the coordinates of the vertex are $(5, -1)$.

43. **A**

$$BC = \frac{1}{2} AB$$

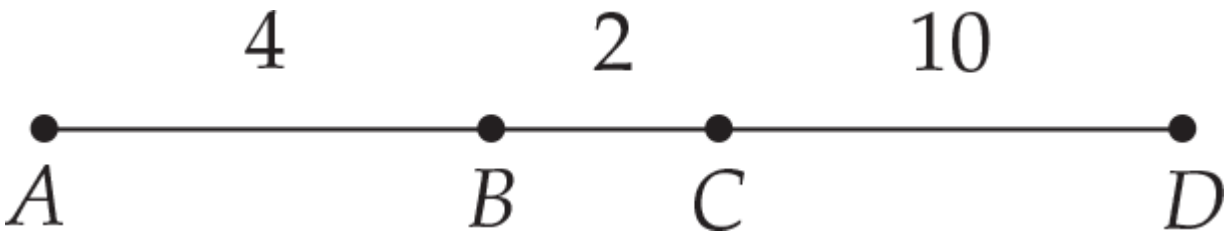
$$BC + CD = \frac{3}{4} AD$$

$$\text{Since } AD = 16,\ BC + CD = \frac{3}{4}(16) = 1$$

$$\text{Since } BC + CD = 12,\ AB =$$

$$\text{Since } BC = \frac{1}{2}\text{AB},$$

$$BC = \frac{1}{2}(4) = 2.$$



The midpoint of $\overline{AD}$ is 8 units from point *A*. Point *C* is 6 units from point *A*. The distance between them is 8 − 6 = 2.

44. **B**

$$12^5 = 3^t \times 4^t$$
$$12^5 = 12^t$$

Since the bases are the same, set the exponents equal to each other.

$t = 5$

45. **E**

|2*x* − 1| > 5 means that 2*x* − 1 is more than 5 units from zero.

$$2x - 1 > 5, 2x > 6, x > 3$$

or

$$2x - 1 < -5, 2x < -4, x < -2$$

46. **E**

(A) $(6^2 \times 6)^5 = (6^3)^5 = 6^{15}$.
(B) $(36)^5 = (6^2)^5 = 6^{10}$.
(C) $(36^2 \times 6^3)^2 = (6^4 \times 6^3)^2 = (6^7)^2 = 6^{14}$.
(D) $(216)^4 = (6^3)^4 = 6^{12}$.
(E) $(6^4)^4 = 6^{16}$.

47. **A**

When $5xy = 2$, $(5xy)^{5xy} = 2^2 = 4$.

48. **C**

Since alternate interior angles of parallel lines are congruent, $m\angle RQU = m\angle QTS$.

$$\begin{aligned} x + 4 &= 2x - 30 \\ x &= 34^\circ \\ m\angle RQU &= 34 + 4 = 38^\circ \\ m\angle QRU &= 180 - (90 + 38) = 180 - 128 = \end{aligned}$$

49. **B**

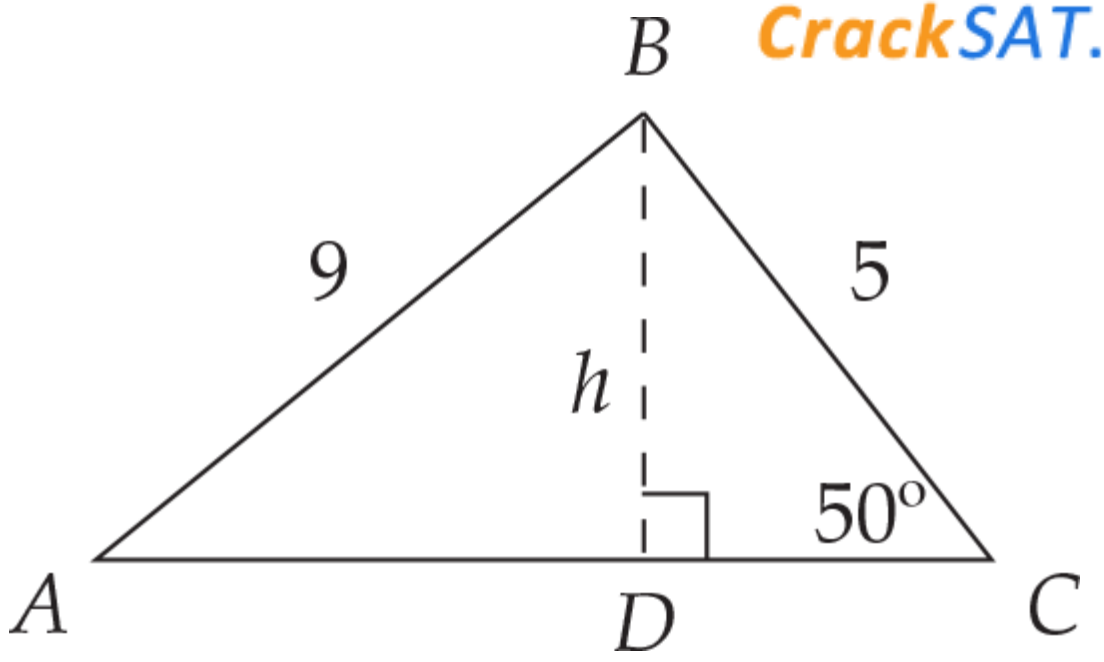
Since triangle *AEF* is a 30–60–90 triangle, the lengths of the sides are in a ratio of $1{:}\sqrt{3}{:}2$. $AF = \frac{1}{2}\ AE$, and $EF = AF\sqrt{3}$.

$$AF = \frac{1}{2} \times 10 = 5$$
$$EF = 5\sqrt{3} \approx 8.66$$

Volume $= \pi r^2 h = \pi(5^2)8.66 \approx 680$.

50. **A**

In order to use the formula $A = \frac{1}{2}\ bh$, find *AC* and the length of the height from vertex *B*.



$$\sin 50^\circ = \frac{h}{5}$$

Use a calculator to determine the value of *h*.

h = 3.83

Use the Pythagorean theorem to find the length of $\overline{AD}$ and $\overline{DC}$.

$$\begin{aligned} 3.83^2 + AD^2 &= 9^2 \\ AD &= 8.14 \\ 3.83^2 + CD^2 &= 5^2 \\ CD &= 3.21 \\ AC = AD + DC &= 11.35 \end{aligned}$$

$$A = \frac{1}{2}\ (11.35)\ (3.83) = 21.7$$

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