1. A rectangle has a length of \((x - 3)\) and a width of \((3x^2 + 4x)\). What is its perimeter?

A. \(3x^3 - 5x^2 - 12x\)  
B. \(3x^3 + 4x^2 - 3\)  
C. \(3x^2 + 5x - 3\)  
D. \(3x^3 - 12x\)  
E. \(6x^2 + 10x - 6\)

*Solution:* E. In order to find the perimeter, add two times the width plus two times the length: \(2(3x^2 + 4x) + 2(x - 3) = 6x^2 + 8x + 2x - 6 = 6x^2 + 10x - 6\)

2. The graph of \(x - 4y + 8 = 0\) crosses the y-axis at \(y = \)

A. -8  
B. 2  
C. 0  
D. -2  
E. 8

*Solution:* B. There are two ways to solve this problem. One is to convert the equation to slope-intercept form: \(x - 4y + 8 = 0\)

\[-4y = -x - 8\]

\[y = \frac{1}{4}x + 2\]

The intercept is 2. This is where the line crosses the y-axis.

The second way to solve the problem is to realize that all points on the y-axis have an x-coordinate of 0. Substituting 0 into the equation, we get

\[x - 4y + 8 = 0\]

\[0 - 4y + 8 = 0\]

\[-4y = -8\]

\[y = 2\]
3. Write the equation of the pictured line

A. \( y = x - 2 \)  
B. \( y = 2 - x \)  
C. \( y = \frac{1}{2} x - 2 \)  
D. \( y = 2x - 2 \)  
E. \( y = -\frac{1}{2} x - 2 \)

**Solution:** C The y-intercept is -2 and the slope is \( \frac{1}{2} \) so the equation of the line is \( y = \frac{1}{2} x - 2 \).

4. The graphs of the equations \( \frac{x + 3y}{3x + 9y} = \frac{2}{12} \) consist of

A. two lines intersecting where \( x = 1 \)  
B. two lines intersection where \( x = \frac{2}{3} \)  
C. two distinct parallel lines  
D. only one line  
E. two lines intersection where \( y = 1 \)

**Solution:** C Convert both equations two y-intercept form:

\[
\begin{align*}
x + 3y &= 2 \\
3y &= -x + 2 \\
y &= -\frac{1}{3}x + \frac{2}{3}
\end{align*}
\]

**************

\[
\begin{align*}
3x + 9y &= 12 \\
9y &= -3x + 12 \\
y &= -\frac{1}{3}x + \frac{4}{3}
\end{align*}
\]

The two equations have the same slope but different intercepts. Therefore, we have two distinct parallel lines.
5. The slope of the line perpendicular to the line \( 3x - 5y + 8 = 0 \)

A. \( \frac{3}{5} \)  
B. \( \frac{5}{3} \)  
C. \( -\frac{3}{5} \)  
D. \( -\frac{5}{3} \)  
E. 3

**Solution:** D Transform \( 3x - 5y + 8 = 0 \) into slope-intercept form.

\[
3x - 5y + 8 = 0 \\
-5y = -3x - 8 \\
y = \frac{3}{5}x + \frac{8}{5}
\]

This slope is \( \frac{3}{5} \), so the slope of the perpendicular line is the negative reciprocal of this which is \( -\frac{5}{3} \).

6. The y-intercept of the line through the two points whose coordinates are (5, -2) and (1, 3) is

A. \( \frac{5}{4} \)  
B. \( -\frac{5}{4} \)  
C. 17  
D. \( \frac{17}{4} \)  
E. 7

**Solution:** D The slope of the line is \( m = \frac{3-(-2)}{1-5} = \frac{5}{-4} = -\frac{5}{4} \)

Using the point-slope form of the line and the second point, we get

\[
y - 3 = -\frac{5}{4}(x-1) \\
y - 3 = -\frac{5}{4}x + \frac{5}{4} \\
y = -\frac{5}{4}x + \frac{5}{4} + 3 \\
y = -\frac{5}{4}x + \frac{5}{4} + \frac{12}{4} \\
y = -\frac{5}{4}x + \frac{17}{4}
\]
7. If \( R = \frac{ST}{S - T} \), then \( S = \) 

A. \( \frac{RT}{T - R} \)  
B. \( \frac{RT}{R - T} \)  
C. \( \frac{RT}{T + R} \)  
D. \( \frac{R + T}{RT} \)  
E. \( \frac{R - T}{RT} \)  

Solution: **B** First, multiply through by \( S - T \)  
\[
R = \frac{ST}{S - T} \quad R(S - T) = ST
\]
Distribute \( RS - RT = ST \)  
Group the terms with \( S \) on one side of the equation: \( RS - ST = RT \)  
Factor out the \( S \): \( S(R - T) = RT \)  
Divide \( S = \frac{RT}{R - T} \)  

8. Write the equation of the line passing through the points (5, 0) and (5, 6).  

A. \( y = 6 \)  
B. \( y = 0 \)  
C. \( x = 5 \)  
D. \( y = 5x \)  
E. \( y = 5x + 6 \)  

Solution: **C** The slope of the line is \( m = \frac{6 - 0}{5 - 5} = \frac{6}{0} \). This is an undefined slope.  
Therefore, we have a vertical line. The equation is \( x = 5 \).
9. Solve the equation: \( \frac{x}{3} + \frac{x}{5} = 2 \)

A. 15  B. \( \frac{15}{4} \)  C. 1

D. \( \frac{1}{8} \)  E. \( \sqrt{30} \)

*Solution:* B Find the common denominator and multiply the equation through by this value. Then solve the equation.

\[
\frac{x}{3} + \frac{x}{5} = 2
\]

\[
15 \left( \frac{x}{3} + \frac{x}{5} = 2 \right)
\]

\[
5x + 3x = 30
\]

\[
8x = 30
\]

\[
x = \frac{15}{4}
\]

10. If \( x=100 \), find the value of \( \sqrt{\frac{x}{16} - \frac{x}{25}} \).

A. 15  B. 5  C. \( \frac{5}{2} \)

D. \( \frac{3}{2} \)  E. \( \frac{1}{2} \)

*Solution:* D Substitute:

\[
\sqrt{\frac{x}{16} - \frac{x}{25}} = \frac{100 - 100}{16 - 25}
\]

Simplify:

\[
\frac{25}{4} - 4 = \frac{25 - 16}{4}
\]

Get a common denominator:

\[
\frac{25}{4} - 4 = \frac{25}{4} - \frac{16}{4}
\]

Subtract and simplify:

\[
\frac{25 - 16}{4} = \frac{9}{4} = \frac{3}{2}
\]
11. Simplify $\sqrt{50x^6y^{12}}$

A. $5x^6y^{10}\sqrt{2}$  
B. $25x^6y^{10}\sqrt{2}$  
C. $25x^4y^6\sqrt{2}$  
D. $5x^4y^6\sqrt{2}$  
E. $5xy\sqrt{2}$

**Solution:** D Factor the expression under the radical (the radicand) into perfect squares and simplify:

$$\sqrt{50x^6y^{12}} = \sqrt{25\cdot2\cdot x^2\cdot x^2\cdot y^2\cdot y^2\cdot y^2\cdot y^2\cdot y^2} = 5\cdot x^3y^{6}\sqrt{2}$$

12. $\sqrt{125} + \sqrt{27} - \sqrt{12}$ is equal to

A. $5\sqrt{5} + \sqrt{3}$  
B. $5\sqrt{5} + \sqrt{15}$  
C. $5\sqrt{5} - \sqrt{3}$  
D. $8\sqrt{8} - 2\sqrt{3}$  
E. $6\sqrt{5}$

**Solution:** A

$$\sqrt{125} + \sqrt{27} - \sqrt{12} = 5\sqrt{5} + 3\sqrt{3} - 2\sqrt{3} = 5\sqrt{5} + \sqrt{3}$$

13. Simplify the expression: $\sqrt{10}\left(\sqrt{2} - \sqrt{5}\right)$

A. $-3\sqrt{7}$  
B. $\sqrt{30}$  
C. $2\sqrt{5} - 5\sqrt{2}$  
D. $7\sqrt{7}$  
E. - 10

**Solution:** C First, distribute and multiply under the radical

$$\sqrt{10}\left(\sqrt{2} - \sqrt{5}\right) = \sqrt{10\cdot2} - \sqrt{10\cdot5} = \sqrt{20} - \sqrt{50}$$

Simplify the radicals. $\sqrt{20} - \sqrt{50} = \sqrt{4\cdot5} - \sqrt{25\cdot2} = 2\sqrt{5} - 5\sqrt{2}$
14. Simplify the expression: \( \sqrt[3]{\frac{50}{27}} \)

A. \( \frac{5\sqrt{6}}{9} \)  
B. \( \frac{25\sqrt{6}}{27} \)  
C. \( \frac{5\sqrt{2}}{9} \)  
D. \( \frac{25\sqrt{2}}{27} \)  
E. \( \frac{25\sqrt{6}}{9} \)

**Solution:** A Separate the quotient and simplify the radicals in the numerator and denominator.

\[
\sqrt[3]{\frac{50}{27}} = \frac{\sqrt[3]{50}}{\sqrt[3]{27}} = \frac{\sqrt[3]{25\cdot2}}{3} = \frac{5\sqrt{2}}{3}.
\]

Rationalize the denominator.

\[
\frac{5\sqrt{2}}{3} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{6}}{3\sqrt{3}} = \frac{5\sqrt{6}}{3\cdot3} = \frac{5\sqrt{6}}{9}.
\]

15. If the point \((-3, \frac{1}{2})\) lies on the graph of the equation \(2x + ky = -11\), find the value of \(k\).

A. \(-\frac{5}{2}\)  
B. -34  
C. -\(\frac{17}{2}\)  
D. -10  
E. -5

**Solution:** D Substitute the point into the equation, simplify and solve for \(k\).

\[
2x + ky = -11
\]

\[
2(-3) + k \left(\frac{1}{2}\right) = -11
\]

\[
-6 + \frac{1}{2} k = -11
\]

\[
\frac{1}{2} k = -5
\]

\[
k = -10
\]

16. Solve the equation: \(5x + 20 - 2x = 10 - (5x + 6)\)

**Solution:** -2 Combine like terms on the left and distribute on the right.

\[
3x + 20 = 10 - 5x - 6
\]

Add \(5x\) to both sides and combine like terms on the right

\[
8x + 20 = 4
\]

Subtract 20 from both sides.

\[
8x = -16
\]

Divide both sides by 8.

\[
x = -2
\]
17. True or False. The line with the equation \( y - 8 = 6(x + 2) \) goes through the point \((8, 2)\).

Solution: False Substitute the point into the equation and determine if the resulting statement is true or false. \( 2 - 8 = 6(8 + 2) \)
\[-6 = 60 \text{ False} \]

18. Arrange the lines \( l, m, p \) and \( q \) in order of increasing slope by writing the letters associated with the lines.

Solution: \( q, l, p, m \)
The lines \( q \) and \( l \) both have negative slopes. Since \( q \) is steeper, it has the least slope. \( p \) is a horizontal line with a slope of 0. \( m \) has a positive slope.

19. Solve the proportion:
\[
\frac{x + 4}{7} = \frac{15 - x}{12}
\]

Solution: 3 First, cross multiply. \( 12(x + 4) = 7(15 - x) \)
Distribute. \( 12x + 48 = 105 - 7x \)
Solve. \( 19x = 57 \)
\( x = 3 \)

20. Find the area of the triangle formed by the lines with equations \( x = 0, \ y = 1, \) and \( 3x + 2y = 14. \)

Solution: 14 Draw a graph of the three lines. The base of the triangle goes from points \((0, 1)\) to \((4, 1)\) so the length is 4. The height of the triangle (left side) extends from the points \((0, 1)\) to \((0, 7)\) so the length is 6. The area of the triangle is, therefore, \((1/2)(4)(6) = 12.\)
21. Expand: \((2x-3)^2\)

**Solution:** \(4x^2 - 12x + 9\)
Using the FOIL method we get,
\[(2x-3)^2 = (2x-3)(2x-3) = 4x^2 - 6x - 6x + 9 = 4x^2 - 12x + 9\]

22. Factor \(12x^2 - x - 1\)

**Solution:** \((3x - 1)(4x + 1)\)

23. Simplify: \(\frac{5x}{8} - \frac{x}{2} + \frac{7x}{4}\)

**Solution:** \(\frac{15x}{8}\)  
Find a common denominator and add the fractions.
\[
\frac{5x}{8} - \frac{x}{2} + \frac{7x}{4} = \frac{5x}{8} - \frac{4x}{8} + \frac{14x}{8} = \frac{15x}{8}
\]

24. Find three consecutive integers whose sum is 480.

**Solution:** \(159, 160, 161\)
The three numbers are \(x, x + 1,\) and \(x + 2\).
The equation is \(x + (x + 1) + (x + 2) = 480\)
3\(x + 3 = 480\)
3\(x = 477\)
\(x = 159\)
The three numbers are 159, 160 and 161.
25. The graph at the right shows the temperature readings for four consecutive hours as read by the school's weather center.

   a. What was the approximate temperature at 2:30 a.m.?

   b. At what time was the temperature the lowest?

   c. Between what two hours did the temperature drop the least?

   d. At what time was the temperature zero?

   Solution:
   a. -14
   b. 3 a.m.
   c. Between 2 a.m. and 3 a.m.
   d. 5:30 a.m.