

**Directions:** Answer each question to the best of your ability, Show ALL of your work for EACH problem in three or more steps. Circle your final answer. You will have to REDO each problem you do not show your work for. If you do not know how to do a problem, circle the number, don't guess. **DO NOT USE A CALCULATOR**

Good Luck!

**Instructions:** For 1-3, simplify each expression.

$$\begin{aligned} 1. & \underline{2a} - 3c - \underline{6a} + 11c = \\ & = 2a - 6a + 11c - 3c \\ & = \underline{-4a + 8c} \end{aligned}$$

$$\begin{aligned} 2. & \sqrt{3}\sqrt{12} \\ & \sqrt{3} \cdot 2\sqrt{3} \\ & = \underline{6} \end{aligned}$$

$$\begin{aligned} 3. & (x^2)^6 \\ & (x^2)^6 = x^{2 \cdot 6} = \underline{x^{12}} \end{aligned}$$

$$4. \text{ If } x - \frac{3}{5}x = 12, \text{ then } x = \underline{30}.$$

$$\begin{aligned} & x - \frac{3}{5}x = 12 \\ & \frac{5}{2} \left( \frac{2}{5}x = 12 \right) \\ & x = 30 \end{aligned}$$

5. Expand this expression:  $(2x + 2y)^2$

$$\begin{aligned} & (2x + 2y)(2x + 2y) \\ & \underline{4x^2 + 8xy + 4y^2} \end{aligned}$$

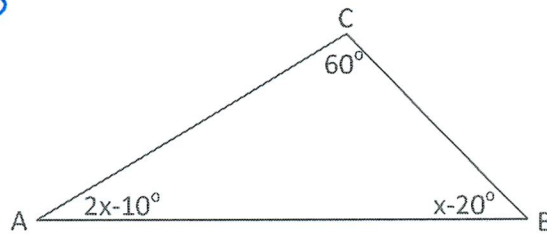
6. In triangle  $\triangle ABC$ , what are the degree measures of angles  $\angle A$  and  $\angle B$ ?

$$60 + 2x - 10 + x - 20 = 180$$

$$30 + 3x = 180$$

$$3x = 150$$

$$x = 50$$



$$\begin{aligned} A &= 2(50) - 10 \\ &= 100 - 10 \\ &= 90^\circ \end{aligned}$$

$$\begin{aligned} B &= 50 - 20 \\ &= 30^\circ \end{aligned}$$

7.  $6^{-4} = \frac{1}{1296}$

$$\frac{1}{6^4}$$

8. Simplify  $\frac{a^6 b^3}{a^2 b^4}$  =  $\frac{1}{a^4 b}$

9. A circle has a diameter of 12 inches. What is its circumference and <sup>area</sup> perimeter?



$$\begin{aligned} P &= 2\pi r \\ &= 2\pi \cdot 6 \\ &= 12\pi \text{ in} \end{aligned}$$

$$\begin{aligned} A &= \pi r^2 \\ &= 36\pi \text{ in}^2 \end{aligned}$$

10. Solve  $(ax + b)(cx + d) = 0$  for  $x$ .

$$ax = -b$$

$$x = \frac{-b}{a}$$

$$cx = -d$$

$$x = \frac{-d}{c}$$

$$x = \left\{ \frac{-b}{a}, \frac{-d}{c} \right\}$$

11. Distribute  $2x^3(x^2 - 3xy + y^2)$ .

$$2x^5 - 6x^4y + 2x^3y^2$$

12. Factor  $6x^2 + x - 12$ .

$$\begin{array}{cc} \wedge & \wedge \\ 2 & 3 \\ 3 & \pm 4 \end{array}$$

$$(2x+3)(3x-4)$$

13. Solve  $-a^3b^2$  if  $a = 3$  and  $b = -2$ .

$$\begin{aligned} & -(3)^3(-2)^2 \\ & -(27)(4) \\ & \textcircled{-108} \end{aligned}$$

14.  $\frac{3}{10} - \frac{4}{12} =$

$$\frac{3 \cdot 12}{10 \cdot 12} - \frac{4 \cdot 10}{12 \cdot 10} = \frac{36}{120} - \frac{40}{120} = \frac{-4}{120} = \frac{-2}{60} = \textcircled{\frac{-1}{30}}$$

15. If  $y = x + 2$  and  $x - 2y = 12$ , then  $x =$   $-16$

$$y = x + 2$$

$$x - 2y = 12$$

$$x - 2(x + 2) = 12$$

$$\begin{array}{r} x - 2x - 4 = 12 \\ +4 \quad +4 \end{array}$$

$$-x = 16$$

$$x = -16$$

16. What is the area of a triangle if the base is 12 inches and the height is 3 yards?

$$3\text{yd} = 9\text{ft} = 108\text{in}$$

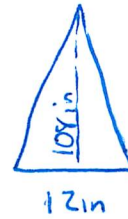
$$A = \frac{1}{2}bh$$

$$= \frac{1}{2}(12)(108)$$

$$= \frac{1}{2}(1296)$$

$$A = 648\text{in}^2$$

$$\begin{array}{r} 648 \\ 2 \overline{)1296} \\ \underline{2} \phantom{00} \\ 12 \phantom{0} \\ \underline{0} \phantom{0} \\ 8 \phantom{0} \\ \underline{16} \phantom{0} \\ 0 \end{array}$$



17. Find the lengths of the missing side of this right triangle.

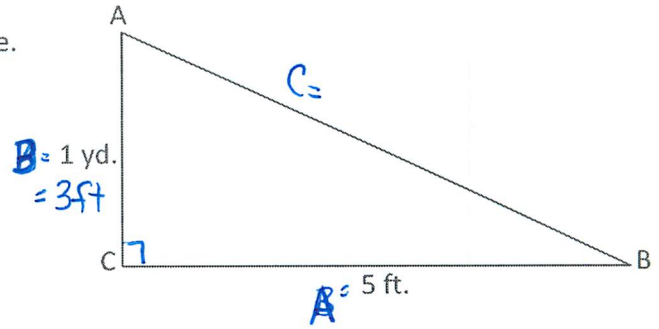
$$A^2 + B^2 = C^2$$

$$3^2 + 5^2 = C^2$$

$$9 + 25 = C^2$$

$$\sqrt{34} = \sqrt{C^2}$$

$$C = \sqrt{34}$$



18.  $\frac{a}{b} + \frac{c}{d} =$

$$\frac{ad}{bd} + \frac{cb}{bd} = \frac{ad + bc}{bd}$$

19. Draw a line that best describes  $x > 5$ .



20. What percent of 9 is 15?

$$9x = 15$$

$$x = \frac{15}{9}$$

$$166.7\%$$

21.  $\sqrt{32} - \sqrt{8} = \underline{2\sqrt{2}}$

$$\sqrt{16}\sqrt{2} - \sqrt{4}\sqrt{2} = 4\sqrt{2} - 2\sqrt{2} = 2\sqrt{2}$$

22. Factor and solve:  $4x^2 - 9$

1)  $(2x+3)(2x-3) = 0$

2)  $2x+3=0$        $2x-3=0$   
 $x = -\frac{3}{2}$        $x = \frac{3}{2}$

23. Solve the following expression for P:  $I = Prt - 12$

$$I = Prt - 12$$

$$\frac{I+12}{rt} = \frac{Prt}{rt}$$

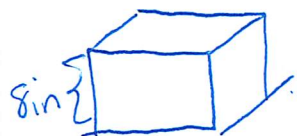
$$\frac{I+12}{rt} = P$$

24. Solve for x:  $\frac{12}{18} = \frac{3}{x}$

$$12x = 54$$

$$x = \frac{54}{12} = \frac{27}{6} = \left(\frac{9}{2}\right)$$

25. A rectangular box has a square base and a height of 8 inches. If the volume of the box is 50 cubic inches, find the dimensions of the base. (Hint: DRAW A PICTURE)



$$b = lw \text{ \& Let } b = x^2.$$

$$50 = hx^2$$

$$= 8x^2$$

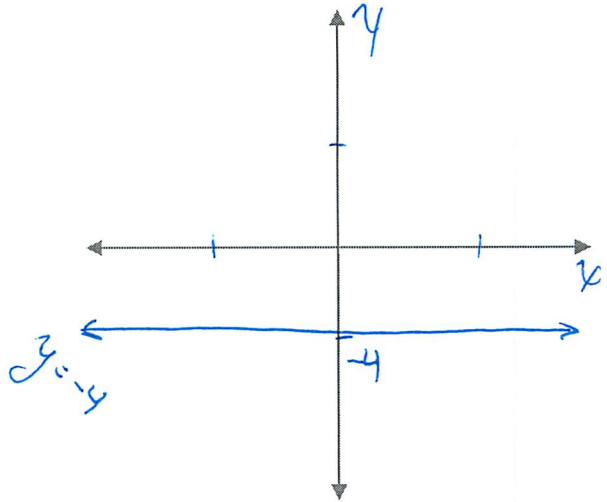
$$\frac{50}{8} = x^2$$

$$\frac{25}{4} = x^2$$

$$\frac{5}{2} = x$$

So, the base side lengths measure 2.5 in each.

26. Draw  $y = -4$  on the graph to the right.



27. Solve for  $x$ :  $\frac{x}{x-1} = \frac{4}{7}$

$$x = 4(x-1)$$

$$x = \frac{4}{3}$$

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

28. What does  $\frac{2a-4b}{6a+7b}$  equal if  $a = 7$  and  $b = -5$ ?

$$\frac{2(7) - 4(-5)}{6(7) + 7(-5)} = \frac{14 + 20}{42 - 35} = \frac{34}{7}$$

29. Simplify  $\sqrt{52}$ .

$$\sqrt{13 \cdot 4} = \sqrt{13 \cdot 2 \cdot 2} = 2\sqrt{13}$$

30.  $(x^2 - 2x - 3) - (-2x^2 + x - 4) =$

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

31. What is the slope of the line  $2x + 3y = 6$ ?

$$3y = 6 - 2x$$

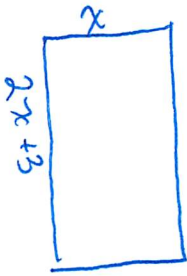
$$y = 2 - \frac{2}{3}x$$

$$y = mx + b$$

↑  
slope

⇒ Slope is  $-\frac{2}{3}$

32. A rectangle has length that is 3 inches longer than twice its width. If the perimeter of the rectangle is 50 inches, what is its width? What is its area?



$$x + x + 2x + 3 + 2x + 3 = 50$$

$$6x + 6 = 50$$

$$6x = 44$$

$$x = \frac{22}{3}$$

$$\text{width} = \frac{22}{3} \quad \text{length} = \frac{53}{3}$$

$$\begin{aligned} A &= lw \\ &= \left(\frac{22}{3}\right)\left(\frac{53}{3}\right) \\ &= \frac{1166}{9} \end{aligned}$$

$$\begin{array}{r} 53 \\ 22 \\ \hline 106 \\ 1060 \\ \hline 1166 \end{array}$$

33.  $\frac{x^2-4}{x-2} =$

$$\frac{(x-2)(x+2)}{(x-2)} = (x+2)$$

34. Two resistors, connected in parallel, have a combined resistance  $R$  which is defined by the equation

$$R = \frac{1}{r_1} + \frac{3}{r_2}$$

where  $r_1$  and  $r_2$  are the resistances of the individual resistors. If  $r_1 = 3$  ohms and  $r_2 = 2$  ohms, find the combined resistance  $R$ .

$$R = \frac{1}{3} + \frac{3}{2}$$

$$= \frac{2}{6} + \frac{9}{6}$$

$$= \frac{11}{6} \text{ ohms}$$

35. Simplify:  $3 - 2x \leq 6x + 5$ .

$$+2x \quad +2x$$

$$3 \leq 8x + 5$$

$$-5$$

$$\frac{-2}{8} \leq \frac{8x}{8}$$

$$-\frac{1}{4} \leq x$$



36. The sum of three consecutive even integers is equal to 84. What are those numbers?

$$\begin{aligned}
 x + x + 2 + x + 4 &= 84 && \text{The numbers are } 26, 28, 30. \\
 3x + 6 &= 84 \\
 \frac{3x}{3} &= \frac{78}{3} \\
 x &= 26
 \end{aligned}$$

37. There are 2500 people in the city of Silvertown. At the end of this year, Silvertown's population is going to go up 5%. What is the new population of Silvertown?

$$2500 + 0.05(2500) = 2625 \text{ people}$$

$$\begin{array}{r}
 2500 \\
 0.05 \\
 \hline
 12500
 \end{array}$$

$$\begin{array}{r}
 2500 \\
 125 \\
 \hline
 2625
 \end{array}$$

38. Hooke's Law tells us that the force required to stretch a spring a given distance is directly proportional to the distance stretched. If 5 pounds of force stretches a spring 3 inches, then 18 pounds of force will stretch the spring by what amount?

$$\begin{aligned}
 \frac{5 \text{ pounds}}{3 \text{ inches}} &= \frac{18 \text{ pounds}}{x \text{ inches}} && \text{for} \\
 5x &= 54 && x = \frac{54}{5} \text{ inches}
 \end{aligned}$$

39a. Write  $4.8 \cdot 10^{-4}$  in decimal notation.

$$0.00048$$

b. Write the number ~~78,000,000~~ in scientific notation.

$$7.8 \times 10^7$$

40. Amy has a pocketful of nickels and quarters worth a total of \$4.35. She has 33 more nickels than quarters. How many quarters does she have?

$$\begin{aligned}
 n &= 33 + q \\
 435 &= 25q + 5n \Rightarrow 435 = 25q + 5(33 + q) = 25q + 165 + 5q = 30q + 165 \\
 435 &= 30q + 165 \Rightarrow \frac{270}{30} = \frac{30q}{30} \quad q = 9 \Rightarrow \text{Amy has } 9 \text{ quarters.} \\
 -165 & \quad -165
 \end{aligned}$$

$$\begin{array}{r}
 25 \quad 42 \\
 9 \quad 5 \\
 \hline
 225 + 210 = 435 \checkmark
 \end{array}$$