

1. Consider the following set of numbers:

$$\{-5.\bar{1}, -\sqrt{9}, -\frac{\pi}{2}, 0, 0.25, 4\frac{6}{7}, \sqrt{27}, \sqrt{36}\}$$

List the numbers in the set that are:

- a. natural numbers

$$\sqrt{36}$$

- b. whole numbers

$$0, \sqrt{36}$$

- c. integers

$$-\sqrt{9}, 0, \sqrt{36}$$

- d. rational numbers

$$-5.\bar{1}, -\sqrt{9}, 0, 0.25, 4\frac{6}{7}, \sqrt{36}$$

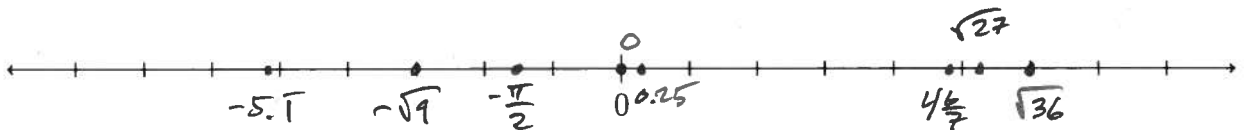
- e. irrational numbers

$$-\frac{\pi}{2}, \sqrt{27}$$

- f. real numbers

All of them

2. Graph each of the numbers from the above set on a number line.



3. Insert either  $>$ ,  $<$  or  $=$  between the two numbers to make a true statement.

a.  $\sqrt{25} < \sqrt{27}$

b.  $\sqrt{27} < \sqrt{36}$

c.  $|\sqrt{2}| = |\sqrt{2}|$

4. Complete the following.

a. What is  $|\sqrt{3}|$ ?  $|\sqrt{3}| = \sqrt{3}$

- d. Convert  $4\frac{3}{5}$  to an improper fraction.

$$4\frac{3}{5} = \frac{23}{5}$$

- b. What is  $\frac{0}{4}$ ?

$$\frac{0}{4} = 0$$

- e. Convert  $\frac{24}{7}$  to a mixed number.

$$\frac{24}{7} = 3\frac{3}{7}$$

- c. Convert  $\frac{2}{9}$  into a decimal.

$$\begin{array}{r} 9 \overline{) 2.000} \\ \underline{18} \phantom{00} \\ 20 \phantom{0} \\ \underline{18} \phantom{0} \\ 20 \phantom{0} \\ \underline{18} \phantom{0} \\ 20 \phantom{0} \\ \underline{18} \phantom{0} \\ 20 \phantom{0} \\ \underline{18} \phantom{0} \\ 20 \phantom{0} \\ \underline{18} \phantom{0} \\ \dots \end{array}$$

$$\frac{2}{9} = 0.\bar{2}$$

5. Write each English sentence as an algebraic equation. Let the variable  $x$  represent the number.

- a. The quotient of 7 and a number yields 5.

$$\frac{7}{x} = 5$$

- b. 5 less than three times a number is 2.

$$3x - 5 = 2$$

6. Perform the indicated operation

$$\begin{aligned} \text{a. } -\frac{3}{7} - \left(-\frac{2}{5}\right) &= -\frac{3}{7} + \frac{2}{5} \\ &= \frac{-15}{35} + \frac{14}{35} = -\frac{1}{35} \end{aligned}$$

$$\begin{aligned} \text{b. } \frac{7}{15} - \left(-\frac{5}{12}\right) &= \frac{7}{15} + \frac{5}{12} \\ &= \frac{28}{60} + \frac{25}{60} \\ &= \frac{53}{60} \end{aligned}$$

$$\text{c. } \frac{\frac{10}{24}}{3} \left(-\frac{7}{28}\right)^1 = -\frac{2}{15}$$

$$\text{d. } \frac{12}{25} \div \frac{14}{15} = \frac{12}{25} \cdot \frac{15}{14} = \frac{18}{35}$$

7. State the multiplicative inverse of each number.

$$\text{a. } \frac{1}{6} \xrightarrow{\text{rec.}} 6$$

$$\text{b. } -\frac{5}{21} \xrightarrow{\text{rec.}} -\frac{21}{5}$$

8. Use order of operations to simplify the following arithmetic expressions.

$$\begin{aligned} \text{a. } 18 - 3(3 - 8)^3 \\ &= 18 - 3(-5)^3 \\ &= 18 - 3(-125) \\ &= 18 + 375 \\ &= 393 \end{aligned}$$

$$\begin{aligned} \text{c. } \left(-\frac{1}{3}\right)^2 - \left(\frac{5}{9} - \frac{2}{3}\right)^2 (9) &= \frac{1}{9} - \left(-\frac{1}{9}\right)^2 (9) \\ &= \frac{1}{9} - \frac{1}{9} \cdot \frac{9}{1} \\ &= \frac{1}{9} - \frac{1}{9} \\ &= 0 \end{aligned}$$

$$\begin{aligned} \text{b. } \frac{4(-4+3)^5 - 7}{2^3 - 2(-3+1)^2} &= \frac{4(-1)^5 - 7}{8 - 2(-2)^2} \\ &= \frac{4(-1) - 7}{8 - 2 \cdot 4} \\ &= \frac{-4 - 7}{8 - 8} \\ &= \frac{-11}{0} \end{aligned}$$

is undefined

$$\begin{aligned} \text{d. } -|14 - (12 - 22)| \\ &= -|14 - (-10)| \\ &= -|24| \\ &= -24 \end{aligned}$$

- 9. Evaluate  $-2x^2 - x$  for  $x = -\frac{2}{3}$ .

$$-2\left(-\frac{2}{3}\right)^2 - \left(-\frac{2}{3}\right) = -2\left(\frac{4}{9}\right) + \frac{2}{3} = -\frac{8}{9} + \frac{6}{9} = -\frac{2}{9}$$

- 10. Simplify each algebraic expression.

a.  $5 - (2x + 8) = 5 - 2x - 8$   
 $= -2x - 3$

b.  $13x^2 + 1 - 2[5(x^2 + 2) - 5]$   
 $= 13x^2 + 1 - 2[5x^2 + 10 - 5]$   
 $= 13x^2 + 1 - 2[5x^2 + 5]$   
 $= 13x^2 + 1 - 10x^2 - 10$   
 $= 3x^2 - 9$

- 11. Determine whether or not  $-4\frac{1}{2}$  is a solution to  $-5 - 3x = -x + 4$ .

$$-5 - 3\left(-4\frac{1}{2}\right) \stackrel{?}{=} -\left(-4\frac{1}{2}\right) + 4$$

$$-5 - 3\left(-\frac{9}{2}\right) = \frac{9}{2} + 4$$

$$-\frac{10}{2} + \frac{27}{2} = \frac{9}{2} + \frac{8}{2}$$

$$\frac{17}{2} = \frac{17}{2} \text{ is true so } -4\frac{1}{2} \text{ is a solution.}$$

- 12. Answer the following questions regarding the polynomial

$$3x - 12x - 18 + 5x.$$

- a. How many terms does it have?

4

- c. What is the coefficient of the 2nd term?

-12

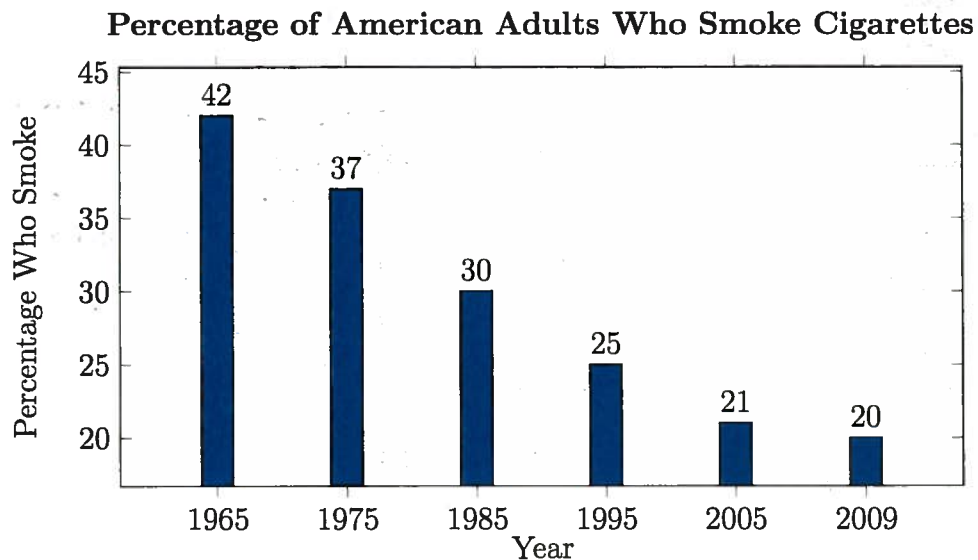
- b. What is the constant term?

-18

- d. Are there any like terms? If so, list them using commas.

Yes:  $3x, -12x, 5x$

13. In the years after warning labels were put on cigarette packs, the number of smokers dropped from approximately two in five adults to one in five. The bar graph shows the percentage of American adults who smoked cigarettes for selected years from 1965 through 2009.



The following mathematical model approximates the percentage of American Adults who spoke cigarettes,  $C$ , where  $x$  is the number of years after 1965.

$$C = -0.5x + 41$$

Use the mathematical model to determine the percentage of American adults who smoked cigarettes in 2005. How does this compare with the actual percentage shown by the bar graph?

*1965 → 2005 so  $x = 40$*

$$\begin{aligned} C &= -0.5(40) + 41 \\ &= -20 + 41 \\ &= 21 \end{aligned}$$

*According to the model about 21% of Americans smoked in 2005. This accurately describes the data in the table.*

14. Solve the equation. State your answers in set notation. If there is **exactly one** solution then show a check.

a.  $2x - 9 + 8x = 5(2x - 3) + 6$

$$10x - 9 = 10x - 15 + 6$$

$$10x - 9 = 10x - 9$$

Every real # is a solution.  
The sol set is  $\mathbb{R}$ .

b.  $\left(\frac{3x}{4} - \frac{1}{2}\right) = \left(\frac{5x}{6} + \frac{1}{3}\right) \cdot \frac{12}{1}$

Check:  $\frac{3 \cdot 12}{1} \cdot \frac{3x}{4} - \frac{6}{1} \cdot \frac{1}{2} = \frac{5x}{1} \cdot \frac{12}{1} + \frac{1}{3} \cdot \frac{12}{1}$

$$\frac{5(-10)}{4} - \frac{1}{2} \stackrel{?}{=} \frac{5(-10)}{6} + \frac{1}{3}$$

$$\frac{-15}{2} - \frac{1}{2} \stackrel{?}{=} \frac{-25}{3} + \frac{1}{3}$$

$$-8 = -8$$

✓

$$\begin{array}{r} 9x - 6 = 10x + 4 \\ -9x - 4 \quad -9x - 4 \\ \hline -10 = x \end{array}$$

The solution is -10.  
The solution set is  $\{-10\}$ .

c.  $3(2x - 5) = -12 + 6x$

$$6x - 15 = 6x - 12$$

There are no solutions  
The solution set is  $\{\}$ .

d.  $-7(x + 2) + 3x = -(3x + 8)$

$$-7x - 14 + 3x = -3x - 8$$

$$-4x - 14 = -3x - 8$$

$$+4x + 8 \quad +4x + 8$$

$$\hline -6 = x$$

The sol is -6.

The sol set is  $\{-6\}$ .

check:

$$-7(-6+2)+3(-6) \stackrel{?}{=} -(-18)$$

$$-7(-4)-18 \stackrel{?}{=} -(-18)$$

$$28-18 \stackrel{?}{=} -(-10)$$

$$10 = 10 \checkmark$$

e.  $\frac{3x}{1} \cdot \frac{20}{1} = \frac{5}{3} \cdot 3x$

$$\frac{60}{5} = \frac{5x}{5}$$

$$12 = x$$

The sol. is 12.

The sol set is  $\{12\}$ .

Check:

$$\frac{20 \cdot 12}{1} \stackrel{?}{=} \frac{5}{3} \cdot 36$$

$$\frac{240}{3} = \frac{180}{3} \checkmark$$

f.  $S = P + Prt$  for  $t$

$$\frac{S-P}{Pr} = \frac{Pr \cdot t}{Pr}$$

$$t = \frac{S-P}{Pr}$$

The solution is  $\frac{S-P}{Pr}$ .

The solution set is  $\left\{ \frac{S-P}{Pr} \right\}$ .

(Alternate form:  $\frac{S}{Pr} - \frac{1}{r}$ ).

15. Translate the given sentence into an algebraic equation using  $x$  as the number. Then solve the equation for  $x$ . Then answer the question using a complete sentence.

The difference between 3 times a number and 10 results in the quotient of 5 and 2, subtracted from the quotient of a number and 2. What is the number?

$$2 \cdot (3x - 10) = \left( \frac{x}{2} - \frac{5}{2} \right) \cdot 2$$

$$\frac{6x - 20}{-x + 20} = \frac{x - 5}{-x + 20}$$

$$5x = 15$$

$$x = 3$$

The number is 3.

16. Translate the following questions into algebraic equations, solve the equation and then answer the question using a complete sentence.

a. What is 8% of 300?

$$x = \frac{8}{100} \cdot 300$$

$$= 24$$

24 is 8% of 300

c. 18 is what percent of 90?

$$18 = \frac{x}{100} \cdot 90$$

$$\frac{10}{9} \cdot 18 = \frac{9}{10} x \cdot \frac{10}{9}$$

$$20 = x$$

18 is 20% of 90.

b. 8 is 40% of what?

$$\frac{100}{40} \cdot 8 = \frac{40}{100} \cdot x \cdot \frac{100}{40}$$

$$20 = x$$

8 is 40% of 20.

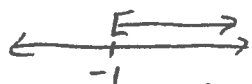
17. Solve the inequality. Write the solution on a number line, using interval notation and set notation.

a.  $2x + \frac{3}{5} \geq -\frac{7}{5}$

$$\frac{-\frac{7}{5} - \frac{3}{5}}{2} \geq -\frac{2}{5}$$

$$2x \geq -2$$

$$x \geq -1$$



The interval of sol. is  $[-1, \infty)$

is  $[-1, \infty)$

The set set is

$\{x \mid x \geq -1\}$ .

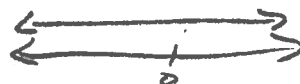
b.  $7x - (x + 1) > 6(x + 3) - 20$

$$6x - 1 > 6x - 2$$

Every real #. is a sol.

The sol set is  $\mathbb{R}$ .

The interval of sol. is  $(-\infty, \infty)$



Calculator Okay for the rest of the problems

18. Two consecutive *odd* integers add up to 32. What are the numbers?

Let  $x$  be the 1<sup>st</sup> # so  $x+2$  is the 2<sup>nd</sup>

$$x + x + 2 = 32$$

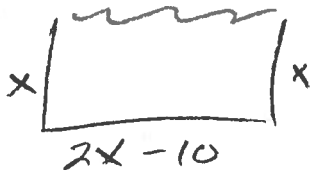
$$2x + 2 = 32$$

$$2x = 30$$

$$x = 15$$

The 1<sup>st</sup> # is 15. The 2<sup>nd</sup> is 17.

19. A rectangular field which runs along a river is fenced in on three sides with the river bordering the fourth side. The total amount of fencing used is 130 yards. The length is 10 yards less than twice the width. Find the width and length of the field.



Let  $x$  = the width in yards

$$x + 2x - 10 + x = 130$$

$$4x - 10 = 130$$

$$4x = 140$$

$$x = 35$$

The width is 35 yards  
or the length is 60 yards

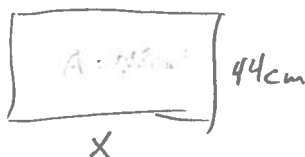
20. While hanging out near the beach in California, you find a new pair of sunglasses which rings up to \$48.375 after a 7.5% sales tax. What was the original price of the sunglasses before tax?

Let  $x$  = the original price.

$$x + .075x = 48.375$$

$$1.075x = 48.375$$

21. A rectangle has a width of 44 centimeters and a perimeter of 188 centimeters. What is the rectangle's length?



$$P = 188 \text{ cm}$$

Let  $x$  = the length in cm

$$2x + 2(44) = 188$$

$$2x + 88 = 188$$

$$\begin{array}{r} -88 \quad -88 \\ \hline 2x = 100 \\ x = 50 \end{array}$$

The length is 50 cm.

22. The circumference of a circle is  $14\pi$  inches. Find the circle's radius and diameter.

$$C = 2\pi r$$

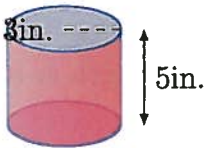
$C =$  circumference in inches  
 $r =$  radius in inches

$$\frac{14\pi}{2\pi} = \frac{2\pi r}{2\pi}$$

$$7 = r$$

The radius is 7 inches  
or the diameter is 14 inches.

23. What is the volume of the following figure?



$$V = \pi r^2 h$$

$V =$  volume in inches cubed  
 $r =$  radius in inches  
 $h =$  height in inches

$$V = \pi(3)^2 \cdot 5$$

$$= 45\pi \approx 141.37$$

The volume is  $45\pi \text{ in}^3$   
or approximately  $141.37 \text{ in}^3$ .

24. One angle of a triangle is twice as large as another. The measure of the third angle is 20 degrees more than that of the smallest angle. Find the measure of each angle.



Let  $x$  be the smallest angle

$$x + 2x + x + 20 = 180 \rightarrow x = 40$$

$$4x + 20 = 180$$

$$4x = 160$$

The 1st angle is  $40^\circ$ , the 2nd is  $80^\circ$ ,  
and the 3rd is  $60^\circ$ .

25. The measure of an angle's supplement is 10 degrees more than three times that of its complement. What is the measure of the original angle?

Let  $x$  be the angle

$$180 - x = 3(90 - x) + 10$$

$$180 - x = 270 - 3x + 10$$

$$180 - x = 280 - 3x$$

$$\rightarrow \begin{array}{r} 180 - x = 280 - 3x \\ -180 + 3x \quad -180 + 3x \\ \hline 2x = 100 \\ x = 50 \end{array}$$

The angle is  $50^\circ$ .

26. Which one of the following is a better buy: a large pizza with a 14-inch diameter for \$12.00 or medium pizza with a 7-inch diameter for \$5.00?



The large is a better buy at only \$0.08/in<sup>2</sup>.

$$\frac{\$}{\text{in}^2}$$

$$\frac{5}{\pi(\frac{7}{2})^2} \approx 0.13 \frac{\$}{\text{in}^2}$$

$$\frac{12}{\pi(7)^2} \approx 0.08 \frac{\$}{\text{in}^2}$$



27. You and your math friend are sitting in the restaurant and you each are enjoying a good cup of coffee while you wait for your food. He pulls out his laptop and connects to the internet via WiFi (isn't the future fantastic?!) to look up how many milligrams of caffeine are in his cup of coffee. The web page he finds explains that there are approximately 120 milligrams of caffeine in a 12 oz cup of coffee. However, the waiter informs you that your cups are 16 oz. How many milligrams of caffeine are in each of your cups of coffee?

$$\frac{\text{mg}}{\text{oz}} \quad 16 \cdot \frac{120}{12} = \frac{x}{16} \cdot 16$$

$$160 = x$$

Let  $x$  be the # of mg of caffeine in the 16 oz cup.  
There are 160 mg of caffeine in the 16 oz cup.

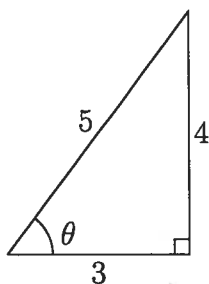
28. The next weekend, you and your math friend decide to get out of town and go fishing at Diamond Lake. The fish and wildlife officer comes along and, after checking your fishing license (which you of course bought), starts chatting with you about the number of fish in the lake. He explains that they tagged 2,000 trout at the beginning of the month and of the 2,400 fish caught since then, only 12 have been tagged. Approximately how many trout is the lake supporting?

$$2000 \cdot \frac{x}{2400} = \frac{2400}{12} \cdot 2000$$

$$x = 400,000$$

Let  $x$  = total # of trout  
There are about 400,000 trout in the lake.

29. Evaluate the three trigonometric functions of the angle  $\theta$  shown in the given right triangle.

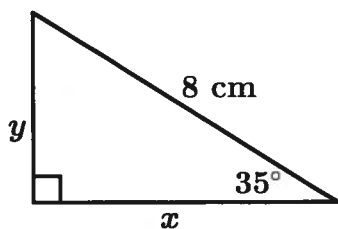


$$\sin \theta = \frac{4}{5}$$

$$\cos \theta = \frac{3}{5}$$

$$\tan \theta = \frac{4}{3}$$

30. Find the lengths of the sides of the triangle ( $x$  and  $y$ ) accurate to 3 decimal places.



$$\sin 35^\circ = \frac{y}{8} \quad \cos 35^\circ = \frac{x}{8}$$

$$y = 8 \sin 35^\circ \approx 4.589$$

$$x = 8 \cos 35^\circ \approx 6.553$$

The opposite side is about 4.589 cm  
& the adjacent side is about 6.553 cm