

Instructions: Please answer legibly, logically, and **show all work**. Your goal is to convince me you understand the material, so no credit will be given for unjustified or unclear work, including guess-and-check. Remember that explaining and words are a critical part of math – if you get stuck, try to explain what you would do if you could get past your sticking point. Be sure to answer the question or perform the task you are asked.

1. (10 pts) Perform the operations, following the correct order. Simplify into a single fraction and reduce if needed.

$$\begin{aligned}
 \text{(a)} \quad & \frac{2 \cdot 2}{3} \cdot \frac{5}{6} + 2 = \frac{4}{6} - \frac{5}{6} + 2 \\
 &= -\frac{1}{6} + \frac{2}{1} \\
 &= -\frac{1}{6} + \frac{2}{1} \cdot \frac{6}{6} \\
 &= -\frac{1}{6} + \frac{12}{6} \\
 &= \frac{11}{6}
 \end{aligned}$$

$$\begin{aligned}
 \text{(b)} \quad & \frac{5}{9} \div \frac{4}{5} + \frac{1}{4} = \frac{5}{9} \cdot \frac{5}{4} + \frac{1}{4} \\
 &= \frac{25}{36} + \frac{1}{4} \cdot \frac{9}{9} \\
 &= \frac{25}{36} + \frac{9}{36} \\
 &= \frac{34}{36}
 \end{aligned}$$

2. (5 pts) Solve for  $x$ .

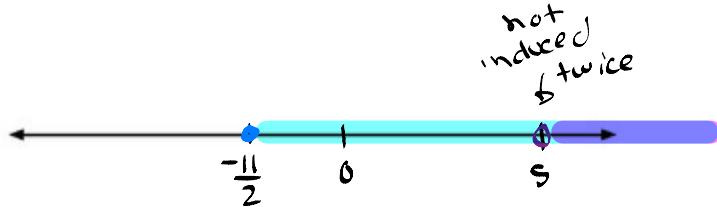
$$\begin{aligned}
 -4(-2x + 2) - 8x &= 4(x - 6) - 2 \\
 (-4)(-2x) - 4(2) - 8x &= 4x + 4(-6) - 2 \\
 \underline{8x} - 8 - \underline{8x} &= \underline{4x} - \underline{24} - 2 \\
 \cancel{8x} - \cancel{8x} - 8 &= 4x - 26
 \end{aligned}$$

$$\begin{aligned}
 -8 &= 4x - 26 \\
 +26 &\qquad +26 \\
 \frac{18}{4} &= \frac{4x}{4} \Rightarrow \frac{18}{4} = x
 \end{aligned}$$

3. (7 pts) Solve the compound inequality and represent it graphically on a number line and in interval notation.

$$2x + 1 \geq -10 \text{ and } 4x + 4 > 24$$

$$\begin{aligned} -1 &-1 &-4 &-4 \\ \frac{2x}{2} &\geq \frac{-11}{2} &\frac{4x}{4} &> \frac{20}{4} \\ x &\geq -\frac{11}{2} &x &> 5 \end{aligned}$$



Interval Notation:  $(5, \infty)$

PICK  $0$ ,

$$0 \geq -\frac{11}{2} ?$$

true so shade side where  $0$  is at (right)

$$0 > 5 ?$$

false, shade side  $0$  is not at

4. (5 pts) Find the solution set to the absolute value equation.

$$6 \left| \frac{1}{2}x - 5 \right| - 1 = 2$$

$$\begin{aligned} &\quad +1 \quad +1 \\ \frac{6 \left| \frac{1}{2}x - 5 \right|}{6} &= \frac{3}{6} \\ \left| \frac{1}{2}x - 5 \right| &= \frac{1}{2} \end{aligned}$$

case 1:  $\frac{1}{2}x - 5 = \frac{1}{2}$

$$\begin{aligned} &\quad +5 \quad +5 \\ \frac{1}{2}x &= \frac{1}{2} + 5 \\ \frac{1}{2}x &= \frac{1}{2} + \frac{5}{1} \cdot \frac{2}{2} \end{aligned}$$

case 2:

$$\begin{aligned} \frac{1}{2}x - 5 &= -\frac{1}{2} \\ &\quad +5 \quad +5 \\ \frac{1}{2}x &= -\frac{1}{2} + 5 \\ \frac{1}{2}x &= -\frac{1}{2} + \frac{5}{1} \cdot \frac{2}{2} \end{aligned}$$

$$\begin{aligned} \frac{1}{2}x &= -\frac{1}{2} + \frac{10}{2} \\ &\quad \cancel{-\frac{1}{2}} \quad \cancel{\frac{10}{2}} \\ x &= 9 \end{aligned}$$

5. (2 pts) Explain why the solution set to the inequality  $|x| > -1$  is  $(-\infty, \infty)$  (aka all real numbers).

every number  $x$  within the abs value is bigger than any negative number.

- 6) (a) (1 pt) Give an example of *any* linear equation written in slope-intercept form.

$$y = 10000x + 100$$

- (b) (2 pts) Give an equation of *any* line perpendicular to the line you gave in part (a).

$$y = -\frac{1}{10000}x + 100$$

Perp

7. (5 pts) Consider the line  $y = 3x - 4$ . Find the equation of the line that is ~~parallel~~ to the given line and passes through the point  $(-7, -6)$ .

$$\begin{aligned}
 & \bullet \quad y = -\frac{1}{3}x - 4 \quad x = -7 \\
 & \text{Find } b \text{ in } y = -\frac{1}{3}x + b \\
 & -6 = -\frac{1}{3}(-7) + b \\
 & -6 = +\frac{7}{3} + b \\
 & -6 - \frac{7}{3} = b \\
 & -\frac{4}{3} - \frac{7}{3} = b \\
 & -\frac{11}{3} = b \\
 & y = -\frac{1}{3}x - \frac{11}{3}
 \end{aligned}$$

8. (5 pts) A new telescope is being used to observe a distant galaxy. The telescope captures an image at a rate of 5 images per hour. The total number of images  $I(t)$  captured after  $t$  hours is given by the function:  $I(t) = 5t$ .

- (a) How many hours have passed if the telescope has captured 75 images?

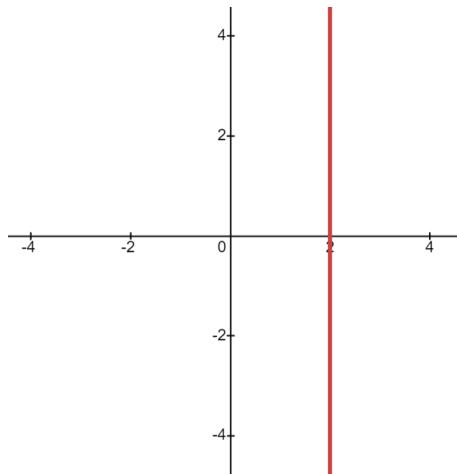
$$\frac{75}{5} = \frac{5t}{5}$$

$$15 = t$$

- (b) How many images will the telescope have captured after 24 hours?

$$\begin{aligned}
 I(24) &= 5(24) \\
 &= 120
 \end{aligned}$$

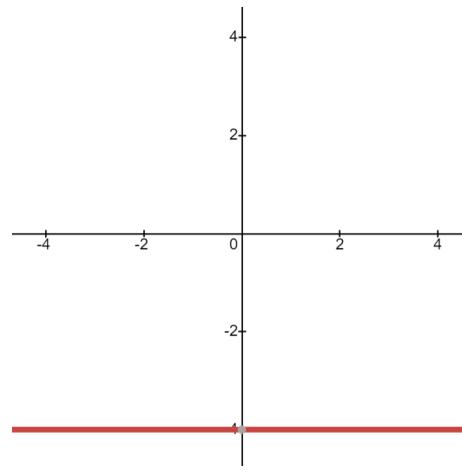
9. (4 pts) Give the slope and state the equation of each graphed line.



(a)

Slope: undefined

Equation:  $x = 2$

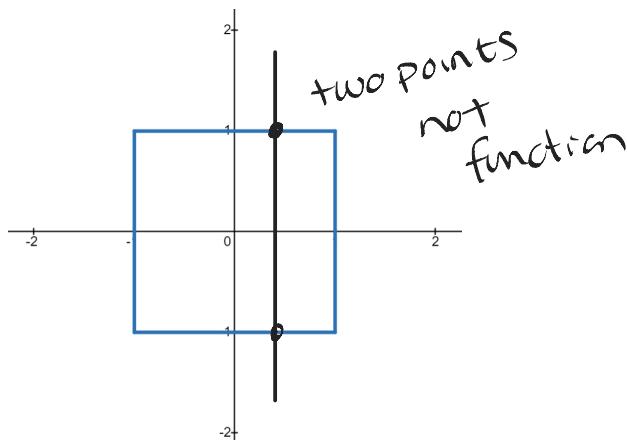


(b)

Slope: 0

Equation:  $y = -4$

10. (6 pts) For each relation graphed below, state if the graph also represents a function and briefly explain how you know. Then give the domain and range in interval notation.

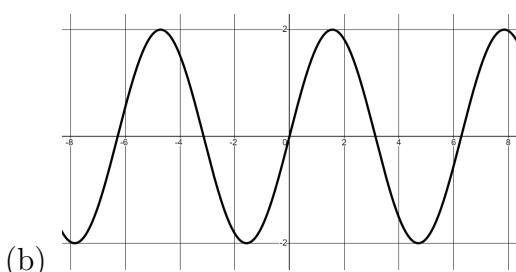


(a)

Function?: no

Domain:  $[-1, 1]$

Range:  $[-1, 1]$



(b)

Function?: yes

Domain:  $(-\infty, \infty)$

Range:  $[-2, 2]$

11. (5 pts) Consider the function  $f(x) = 5x + 7$ .

(a) Find  $f(-4)$ .

$$\begin{aligned} &= 5(-4) + 7 \\ &= -20 + 7 \\ &= -13 \end{aligned}$$

(b) Find the value of  $x$  such that  $f(x) = 27$ .

$$\begin{aligned} 27 &= 5x + 7 \\ -7 &\quad -7 \\ 20 &= 5x \\ \frac{20}{5} &= \frac{5x}{5} \\ 4 &= x \end{aligned}$$

12. (5 pts) Solve the system of linear equations.

$$\begin{cases} -4x = 8 + 2y \Rightarrow -4x - 8 = 2y \Rightarrow -2x - 4 = y \\ 10x + 7 = 4y \end{cases}$$

10x + 7 = 4(-2x - 4)

10x + 7 = -8x - 16

+8x      +8x

18x + 7 = -16

-7      -7

$\frac{18x}{18} = -\frac{23}{18}$

$x = -\frac{23}{18}$

Plug in  $x = -\frac{23}{18}$  into  $-2x - 4 = y$  to get  $y$ .

$$\begin{aligned} -2\left(\frac{-23}{18}\right) - 4 &= y \\ -2\left(\frac{23}{18}\right) - 4 &= y \\ -\left(\frac{23}{9}\right) - 4 &= y \\ \frac{23}{9} - 4 &= y \\ \frac{23}{9} - \frac{4}{1} \cdot \frac{9}{9} &= y \\ \frac{23}{9} - \frac{36}{9} &= y \end{aligned}$$

13. (7 pts) Ben and Jack are selling popcorn and wrapping paper to raise money for the Math Club. Yesterday, Ben sold 4 tins of popcorn and 6 rolls of wrapping paper and earned \$36. Jack sold 6 tins of popcorn and 2 rolls of wrapping paper and earned \$26. Find the cost of each tin of popcorn and each roll of wrapping paper. [Make sure to clearly define variables, set up equation(s), and solve them].

$$\begin{aligned}x &= \text{cost of popcorn} \\y &= \text{cost of wrapping paper} \\ \text{Ben's sale} \quad 4x + 6y &= 36 \\ \text{Jack's sale} \quad 6x + 2y &= 26 \\ \text{Do the same as question 12} \\ 6(4x + 6y = 36) \\ -4(6x + 2y = 26) \\ 24x + 36y = 216 \\ -24x - 8y = -104 \\ \frac{28y}{28} &= \frac{112}{28} \\ y &= 4\end{aligned}$$

$$\begin{aligned}6x + 2(4) &= 26 \\6x + 8 &= 26 \\6x &= 18 \\x &= 3\end{aligned}$$

14. (7 pts) Graph and clearly identify the solution set to the system of linear inequalities.

$$\begin{cases} y \leq \frac{1}{2}x + 2 & \text{solid line, start at } (0, 2) \\ 2x + y < -3 & \text{dotted line, start at } (0, -3) \end{cases}$$

Use the area below to show any work used in graphing the solution set. No credit will be given for shading without reason.

① solve for y

$$\begin{aligned}2x + y &< -3 \\-2x &\quad -2x \\y &< -2x - 3 \quad \text{start at } (-3, 0)\end{aligned}$$

② shading  $(0, 0)$

$$\begin{aligned}y &\leq \frac{1}{2}x + 2 \\0 &\leq \frac{1}{2}(0) + 2 \\0 &\leq 2 \quad \text{true}\end{aligned}$$

$$\begin{aligned}y &< -2x - 3 \\0 &< -2(0) - 3 \\0 &< -3 \quad \text{false}\end{aligned}$$

