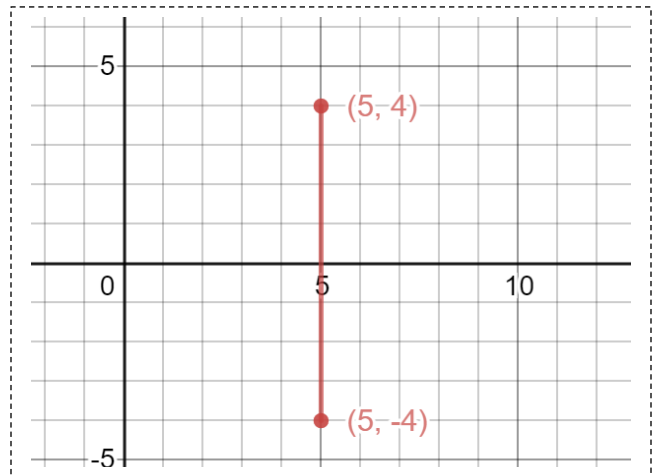
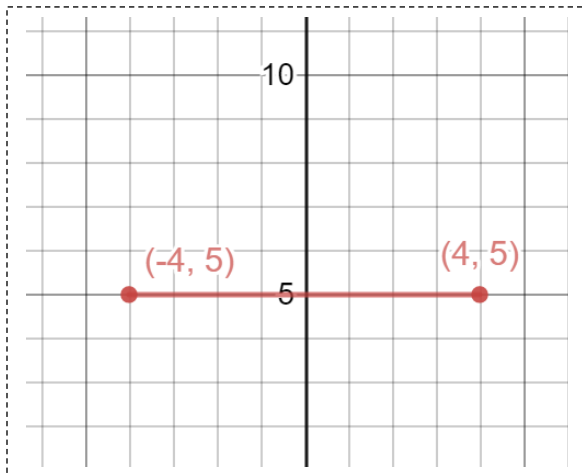


## Section 2.4 – Solving Slope Problems and Vertical/Horizontal

### Vertical and Horizontal Lines

- Vertical and Horizontal Lines have interesting Slope characteristics.
- Think back about slope; it was all about the steepness of the incline.
- Well what happens when the line is horizontal? What about a vertical line?

**Example 1:** What is the slope of the two following lines? Use the slope equation.



**Solution 1:**

**Slope Equation:**

Let  $(-4, 5)$  be point 1; Let  $(4, 5)$  be point 2

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{5 - 5}{4 - (-4)} = \frac{0}{8} = 0$$

The **Slope** of a **HORIZONTAL LINE** is: **0**

- Zero divided by anything is 0

**Slope Equation:**

Let  $(5, 4)$  be point 1; Let  $(5, -4)$  be point 2

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-4) - 4}{5 - 5} = \frac{-8}{0} = \text{Undefined}$$

The **Slope** of a **VERTICAL LINE** is: **Undefined**

- We cannot divide by zero, it is undefined.

**Example 2:** What is the slope of a line with points at:  $(0, -5)$  and  $(6, -5)$ . What kind of line is it?

**Solution 2:** Using the slope equation

Let  $(0, -5)$  be point 1; Let  $(6, -5)$  be point 2

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-5 - (-5)}{6 - (0)} = \frac{0}{6} = 0$$

Since **the Slope** of the line is: **0**

It is a **HORIZONTAL LINE**

**Solving Slope Problems**

- Determining a slope can be relatively straightforward, but the challenge lies in solving for other pieces of information.
- This will require working with proportions (fractions) and basic algebra
- Showing your steps is very helpful, sometimes converting to decimals can be handy too

**Example 3:** Kevin is installing a pipe that needs to be at a 4% grade (this allows for drainage flow using gravity). The vertical drop has to be *half an inch*, what does the run have to be for decrease in height?

**Solution 3:** First we need to consider what 4% is.

$$4\% = \frac{4}{100}$$

With this information we have our desired slope. But it can be simplified.

$$\frac{4}{100} = \frac{1}{25}$$

It is easier to solve these proportions if we can simplify, particularly if we can convert to a decimal. Here we can, but let's see it as a fraction proportion. We know the **RISE** we need the **RUN** because remember:

$$\text{Slope} = \frac{\text{Rise}}{\text{Run}}$$

So...

$$\frac{1}{25} = \frac{0.5}{x}$$

Multiply both sides by the lowest common denominator ( $25x$ ), things will cancel (Cross Multiplying)

$$\boxed{25's \text{ cancel here}} \quad \cancel{25}x \cdot \frac{1}{\cancel{25}} = \frac{0.5}{x} \cdot 25\cancel{x} \quad \boxed{x's \text{ cancel here}}$$

$$x = 0.5 \cdot 25 \quad \rightarrow \quad x = 12.5$$

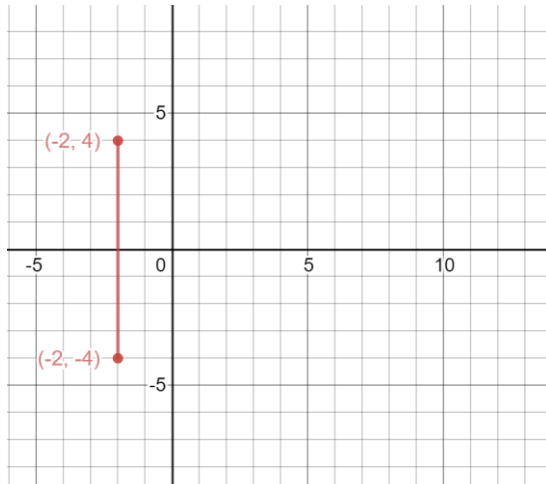
**For every *half an inch* of height change we need *12.5 inches* of length!**

**This stuff is all about algebra and fractions. Let's get good at this here, we will see it again in Section 4.**

### Section 2.4 – Practice Problems

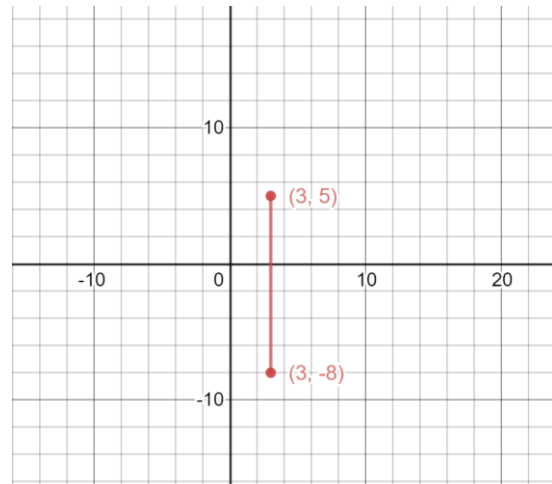
1. Use the slope formula to determine the slope of the following lines.

a)



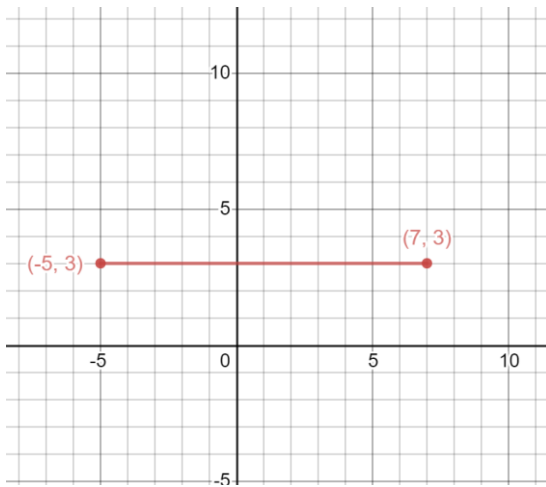
Work Space

b)



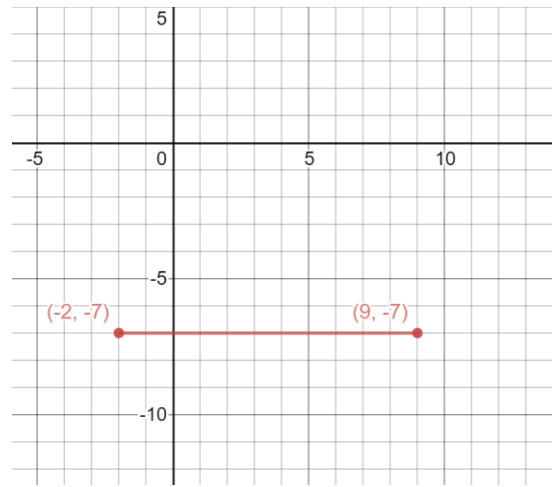
Work Space

c)



Work Space

d)



Work Space

2. Is the line joining the following two points vertical, horizontal, or neither. Prove your statement using the Slope Formula.

a)  $(34.5, 2.6)$  and  $(45.0, 2.6)$

b)  $(68, 10)$  and  $(52, 12)$

c)  $(40, 100)$  and  $(40, 200)$

d)  $(31, 5)$  and  $(62, 12)$

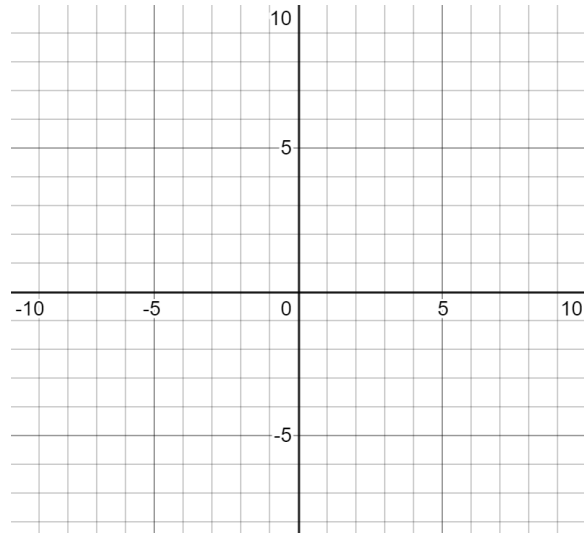
e)  $(4, 2)$  and  $(2, 4)$

f)  $(0, 5)$  and  $(0, -2)$

3. Order the slopes in the previous question from flattest to steepest.

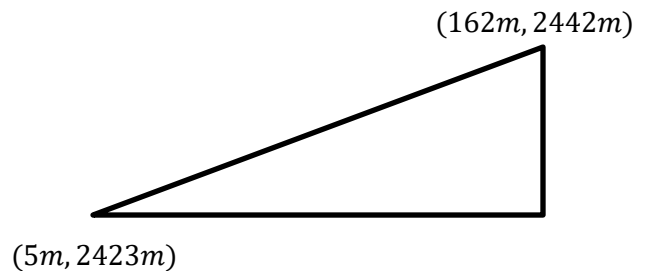
4. Jake knows that the average slope of his Green Chair ski run is:  $\frac{9}{20}$ . The coordinates of the top and bottom of the ski run are:  $(2m, 0m)$  and  $(1250m, y)$ . What is the missing coordinate?

5. A line connecting the points  $(x, 5)$  and  $(4, 8)$  has a slope of 0.3. What is the missing coordinate? And once you have found it, graph the points and the line on the grid provided. Check your line to ensure you are correct.



6. Phil is a mountain biker, he has built a ramp in his backyard. He wants the slope of his ramp to be  $\frac{4}{11}$ . He needs the height of the ramp to be  $8m$ . How long should the base of the ramp be? Use the Pythagorean Theorem  $a^2 + b^2 = c^2$  to find the length of the ramp itself.

7. Ashley works for a Powerline company. The contractor needs a power-line set-up from the bottom of a hill to the top. What is the slope of the Powerline connection.



**Section 2.4 – Answer Key**

1. a) <i>Undefined</i> b) <i>Undefined</i> c) 0 d) 0
2. a) Horizontal b) Neither c) Vertical d) Neither e) Neither f) Vertical
3. <i>a, d, b, e, c, f (c and f and interchangeable)</i>
4. $y = 561.6m$
5. $x = -6$
6. <i>Base = 22m; Ramp (Diagonal) = 23.4</i>
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