(4) Pythagorean Theorem and Midpoint Theorem

Slope-Intercept Form

$$y = mx + b$$

- Slope
- Rate of change (per)
- Coefficient

- y-intercept
- Initial "value"
- Constant

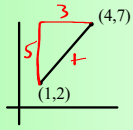
Methods of Finding Slope

Ex: (1,2) and (4,7)

- Slope Formula $m = \frac{y_2 - y_1}{x_2 - x_1}$ $\frac{7-2}{4-1} = \frac{5}{3}$

- Graphical Method

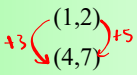
$\frac{\text{Rise}}{\text{Run}}$



slope $= \frac{5}{3}$

- Stack Method

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



slope $= \frac{5}{3}$

Slopes

- Parallel Lines = Same slope
- Perpendicular Lines = Slopes are opposite reciprocals

Fill in the missing slopes in the table below.

Slope	Slope of Parallel Line	Slope of Perpendicular Line
$\frac{2}{3}$	$\frac{2}{3}$	$-\frac{3}{2}$
$-5 = -\frac{5}{1}$	$-\frac{5}{1}$	$\frac{1}{5}$
$4\frac{1}{5} = \frac{21}{5}$	$\frac{21}{5}$	$-\frac{5}{21}$
$1.6 = \frac{16}{10} = \frac{8}{5}$	$\frac{8}{5}$	$-\frac{5}{8}$

ACT/SAT Example

Which two lines are perpendicular?

F $y = -5x + 2$ and $2y - 10x = 4$ → $2y = 10x + 4$, $y = 5x + 4$ NOT RECIP.

G $y = \frac{1}{4}x + 1$ and $y = 4x + 2$ NOT OPP.

H $y = 3x + 1$ and $y - 4x = 6$ → $y = 4x + 6$ ✗

J $y = \frac{1}{2}x + 2$ and $y + 2x = -4$ → $y = -2x - 4$ ✓

Midpoint Formula

The midpoint of a segment can be found using the formula:

$$M(x,y) = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

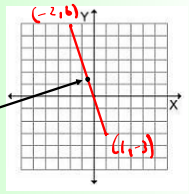
Average of x-values — Average of y-values

Example: Find the midpoint of a segment with endpoints at (1,-3) and (-2,6).

$x = \frac{1+(-2)}{2}$ $y = \frac{-3+6}{2}$

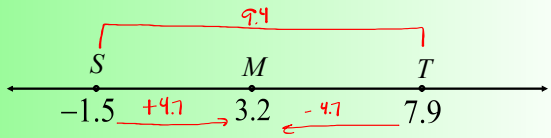
$x = -\frac{1}{2}$ $y = \frac{3}{2}$

$M\left(-\frac{1}{2}, \frac{3}{2}\right)$



Midpoint Formula

2.) Find the coordinate of the midpoint, M, of segment ST.



$7.9 - (-1.5)$

$7.9 + 1.5$

9.4

$\frac{9.4}{2} = 4.7$

(4) Pythagorean Theorem and Midpoint Theorem

A **median** is a segment starting at one vertex of a triangle and ending at the midpoint of the opposite side. Find the slope of the **median** of triangle ABC that goes to side AC.