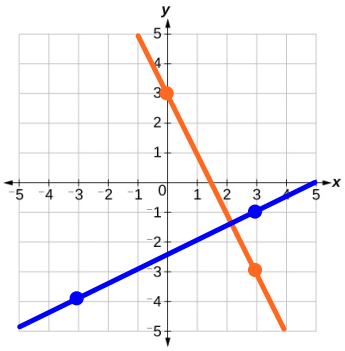
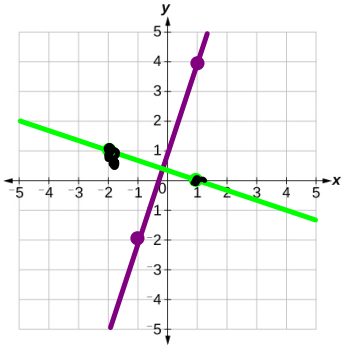


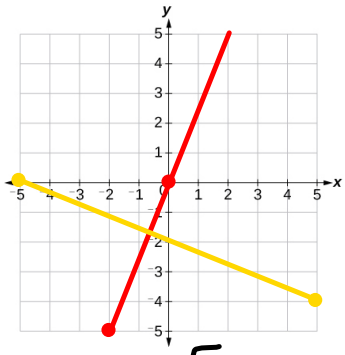
a= -2

a= $\frac{1}{2}$



a= 3

a= $-\frac{1}{3}$



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

a= $-\frac{2}{5}$

**What do you notice?**

# Perpendicular Lines

Two lines are perpendicular if their slope (a) are the negative reciprocals of each other.

*Negative* → switch the sign

*Reciprocal* → flip the fraction

Examples:

1) $a=\frac{5}{16}$ and $a=-\frac{16}{5}$ → perpendicular

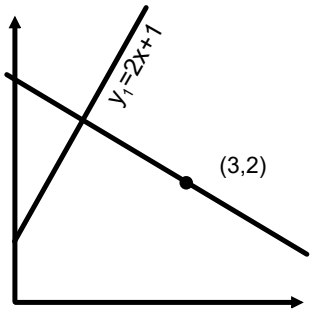
2) $y=5x+2$ and $y=-\frac{1}{5}x-3$ → perp.

3) $y=1.5x+1$ ($a:\frac{3}{2}$) and $y=-\frac{2}{3}x$ → perp.

4) $a=5$ and $a=-\frac{1}{5}$ → perp.

5) $y=5$ and $x=17$ → perp.

**Find the equation of a line that is perpendicular to a line $y_1$, passing through a point (X,Y).**




**Ex. 1:**

**$y_2=ax+b$**

**1) a?** *Find the slope of $y_1$*

$a=2$

**2) $a_P$:** $2 \rightarrow -\frac{1}{2}$

**3) b?** *Replace x,y in the equation by (X,Y) and solve for b.*

$y=-\frac{1}{2}x+b$

$2=-\frac{1}{2}(3)+b$

$\times 1.5$

$2=-1.5+b$

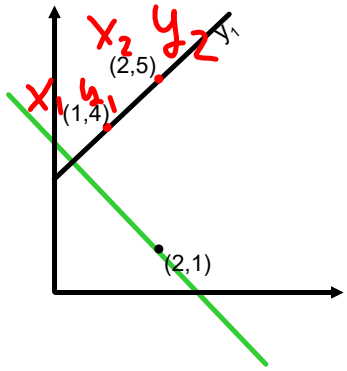
$b=2+1.5=3.5$

**4) Answer:** *State the equation in the form y=ax+b*

$y=-\frac{1}{2}x+3.5$

**Find the equation of a line that is perpendicular to a line $y_1$, passing through a point (X,Y).**

**Ex. 2:**




**$y_2$=ax+b**

**1) a?** *Find the slope of $y_1$*

$$a = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{5-4}{2-1}$$

$$= \frac{1}{1} = 1$$

**2) $a_P$:**

$$\frac{1}{1} \longrightarrow -\frac{1}{1} = -1$$

**3) b?** *Replace x,y in the equation by (X,Y) and solve for b.*

$y = ax + b$

$y = -x + b$

$1 = -2 + b$ (+2)

$b = 2 + 1 = 3$

**4) Answer:** *State the equation in the form y=ax+b*

$y = -x + 3$

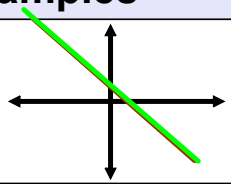
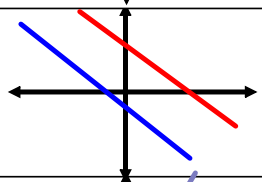
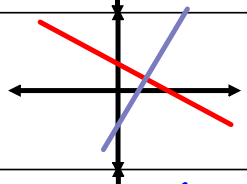
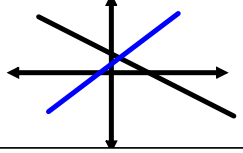
## Relative Position

**Remember:** parallel lines ⟺ the same slope (a).

There are two types of parallel lines:

- distinct (different b)
- coincident (same b)

**Relative position - summary**

| Position | Slope (a) | Initial value (b) | Examples |
|---|---|---|---|
| Parallel coincident | same | same |  |
| Parallel distinct | same | different |  |
| Perpendicular | negative reciprocals | – |  |
| Intersecting | other | – |  |