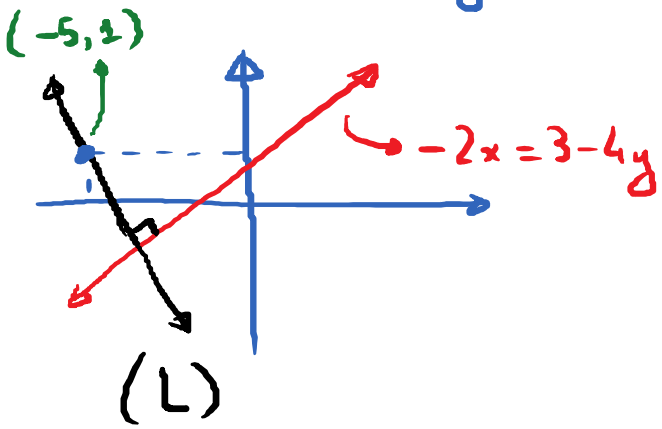
$$y - 5 = -\frac{2}{5}x + \frac{8}{5} \rightarrow y = -\frac{2}{5}x + \frac{8}{5} + \frac{5 \cdot 5}{1 \cdot 5}$$

$$\rightarrow \boxed{y = -\frac{2}{5}x + \frac{33}{5}}$$

E.g. Find the slope-intercept equation of the line (L) containing the point $(-5, 1)$ and perpendicular to the line

$$-2x = 3 - 4y.$$



Step 1: $-2x = 3 - 4y$

$$\rightarrow -2x - 3 = -4y$$

$$\rightarrow -4y = -2x - 3$$

$$\rightarrow y = \frac{1}{2}x + \frac{3}{4}$$

Slope $= \frac{1}{2}$.

Step 2: Since (L) is perpendicular to this, the slope of (L) is -2. Pt $(-5, 1)$ is on (L). So

$$y - 1 = -2(x + 5)$$

$y - 1 = -2x - 10 \rightarrow \boxed{y = -2x - 9}$

(2) Applications

E.g. The average monthly expenses in a given year of a company is given by:

Year	Average monthly expenses
2009	$20,000
2011	$19,000

Q1: Let t = # of years after 2000.

y = average monthly expenses.

Find a linear function of y in terms of t that fits this data.

Q2: Use this function to predict the average monthly expenses in the year 2020.

Q1: Data Points

t	y	
9	20000	$\rightarrow (9, 20000)$
11	19000	$\rightarrow (11, 19000)$

Find the linear model $\equiv$ Find the equation $y = mt + b$ of the line containing these 2 points.

Step 1: Find slope $m = \dfrac{19000 - 20000}{11 - 9}$

$$m = \frac{-1000}{2} = \boxed{-500}$$

Step 2: Point-Slope Form

$$y - 20000 = -500(t - 9)$$

Step 3: Isolate y.

$$y = -500t + 4500 + 20000$$

$$\boxed{y = -500t + 24500}$$

Q2: The year 2020 corresponds to $t = 20$

Expenses in year 2020: $y = -500 \cdot (20) + 24500$

$$\boxed{y = 14500}$$

E.g. Suppose buyers are willing to buy 100 items of a product when the price of each item is \$10. They are willing to buy 70 items when the price per item is increased to \$12.

Q1: Find a linear function to express the # of items buyers are willing to buy as a function of the price per item.

Let p = the price per item. let q = # items buyers are willing to buy at price q.

Q2: Use this function to predict the # of items buyers are willing to buy when the price is $15.

Q1: Data points

p	q	
10	100	→ (10, 100)
12	70	→ (12, 70)

Find the linear function $q = mp + b$

Step 1: Find Slope $= \frac{70 - 100}{12 - 10} = \frac{-30}{2} = -15$

Step 2: Point-Slope Form:

$$q - 100 = -15(p - 10)$$

Step 3: Slope-intercept Form:

$$q = -15p + 150 + 100$$

$$\boxed{q = -15p + 250}$$

Q2: Find q when $p = 15$.

$$q = -15 \cdot 15 + 250 = \boxed{25}$$

E.g. In 2005, the # of students participating in sports at a college was 150. In 2010, the # had risen to 320 students.

Q1: Find a linear function that fits this data.

Let x = # of years since 2005.

N = # of students participating in sports in year x.

Q2: Use this function to predict the # of students participating in sports in the year 2018.

Q1: Data points

x	N	
0	150	$\rightarrow (0,150)$ $\rightarrow$ y-intercept
5	320	$\rightarrow (5,320)$

Find the linear function $N = mx + b$.

Step 1: Slope $= \dfrac{320 - 150}{5 - 0} = \dfrac{170}{5} = 34$

Step 2: $\boxed{N = 34x + 150}$

Q2: Year 2018 corresponds to $x = 13$

Find N when $x = 13$.

$N = 34 \cdot 13 + 150 = \boxed{592}$