Eqn of Line through given points (x_1, y_1) (x_2, y_2)

Ex1 Find eqn of line through
$(1, 4)$ and $(5, 12)$

First find gradient $= \dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{12-4}{5-1} = \dfrac{8}{4} = 2$

Line $y = 2x + c$

Sub $(5, 12)$

$$12 = 2(5) + c$$
$$12 = 10 + c$$
$$12 - 10 = c$$
$$2 = c$$

$$\underline{y = 2x + 2}$$

Ex2 Line through
$(-3, 7)$ and $(1, -3)$

gradient $\dfrac{y_2 - y_1}{x_2 - x_1} = \dfrac{-3-7}{1--3} = \dfrac{-10}{4} = -\dfrac{5}{2}$

$$y = -\frac{5}{2}x + c$$

Sub $(-3, 7)$

$$7 = -\frac{5}{2}(-3) + c$$

$$7 = \frac{15}{2} + c$$

$$\frac{14}{2} - \frac{15}{2} = c$$

$$-\frac{1}{2} = c$$

$$\underline{y = -\frac{5}{2}x - \frac{1}{2}}$$

Ex 3 Line through $(3, 8)$ and $(5, -4)$

$$\text{gradient} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-4-8}{5-3} = \frac{-12}{2} = -6$$

$$y = -6x + c$$

Sub $(3, 8)$

$$8 = -6(3) + c$$

$$8 = -18 + c$$

$$8 + 18 = c$$

$$26 = c$$

$$\underline{y = -6x + 26}$$

Exercise

1) Line through $(4, 1)$ and $(7, 10)$

$$y = 3x - 11$$

2) Line through $(4, 5)$ and $(-2, 2)$

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{2-5}{-2-4} = \frac{-3}{-6} = +\frac{1}{2}$$

$$y = \frac{1}{2}x + c$$

Sub $(4, 5)$

$$5 = \frac{1}{2}(4) + c$$

$$5 = 2 + c$$

$$5 - 2 = c$$

$$3 = c$$

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

Finding the midpoint of (x_1, y_1) and (x_2, y_2)

$$\text{Midpoint} = \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Ex1 $(4, 7)$ and $(6, 1)$

$$\text{Midpoint} \left(\frac{4+6}{2}, \frac{7+1}{2}\right) = (5, 4)$$

Ex2 $(-7, 4)$ and $(-11, -5)$

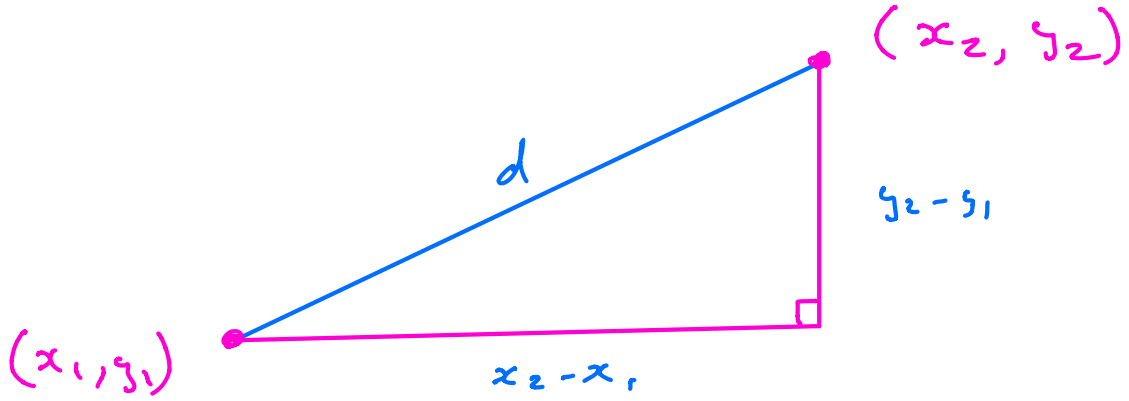
$$\text{Midpoint} \left(\frac{-7 + -11}{2}, \frac{4 + -5}{2}\right)$$

$$= \left(\frac{-7-11}{2} , \frac{4-5}{2} \right)$$

$$= \left(\frac{-18}{2} , \frac{-1}{2} \right)$$

$$= \left(-9, -\tfrac{1}{2} \right)$$

Distance Between Two Points (x_1, y_1) and (x_2, y_2)



By Pythagoras $d^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Ex1 Find distance between $(4, 9)$ and $(7, 5)$

$$d = \sqrt{(7-4)^2 + (5-9)^2}$$

$$d = \sqrt{9 + 16} = \sqrt{25} = 5 \text{ units}$$

Ex2 Find distance between

$(-3, 7)$ and $(2, 19)$

$$d = \sqrt{(2 - -3)^2 + (19 - 7)^2}$$

$$= \sqrt{25 + 144}$$

$$= \sqrt{169} \qquad = 13 \text{ units}$$

Exercise Find distance between

1) $(1, 7)$ and $(7, 15)$

$$d = \sqrt{(7-1)^2 + (15-7)^2}$$

$$= \sqrt{36 + 64}$$

$$= \sqrt{100} \qquad = 10 \text{ units}$$

---

2) Find distance between

$(-5, 3)$ and $(2, 27)$

$$d = \sqrt{(2 - -5)^2 + (27-3)^2}$$

$$= \sqrt{49 + 576}$$

$$= \sqrt{625} \qquad = 25 \text{ units}$$

3) Find distance between

$(-1, -3)$ and $(7, 12)$

$$d = \sqrt{(7--1)^2 + (12--3)^2}$$

$$d = \sqrt{8^2 + 15^2}$$

$$= \sqrt{64 + 225}$$

$$= \sqrt{289} = 17 \text{ units}$$

Well known Pythagorean Triples

$(3, 4, 5)$ $(5, 12, 13)$ $(7, 24, 25)$ $(8, 15, 17)$