

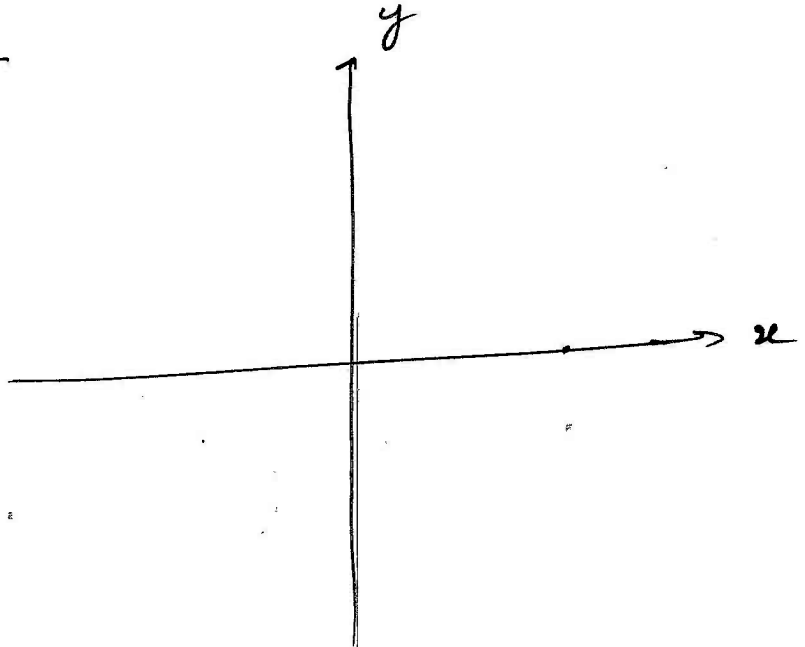
graphs

①

15-10-2018

Coordinate geometry  
(Straight lines)

coordinate axis



on x-axis  
 $y=0$

on y-axis  
 $x=0$

Two point

$A(x_1, y_1)$

$B(x_2, y_2)$

① Distance between two points  
(length of line between two points)

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

$$A(3, 5) \quad B(-2, 8) \quad \textcircled{2}$$

$$\begin{aligned} \text{distance} &= \sqrt{(-2-3)^2 + (8-5)^2} \\ &= \sqrt{25 + 9} \\ &= \sqrt{34} \\ &= 5.83 \text{ units} \end{aligned}$$

② Mid-point

$$A(x_1, y_1) \quad B(x_2, y_2)$$

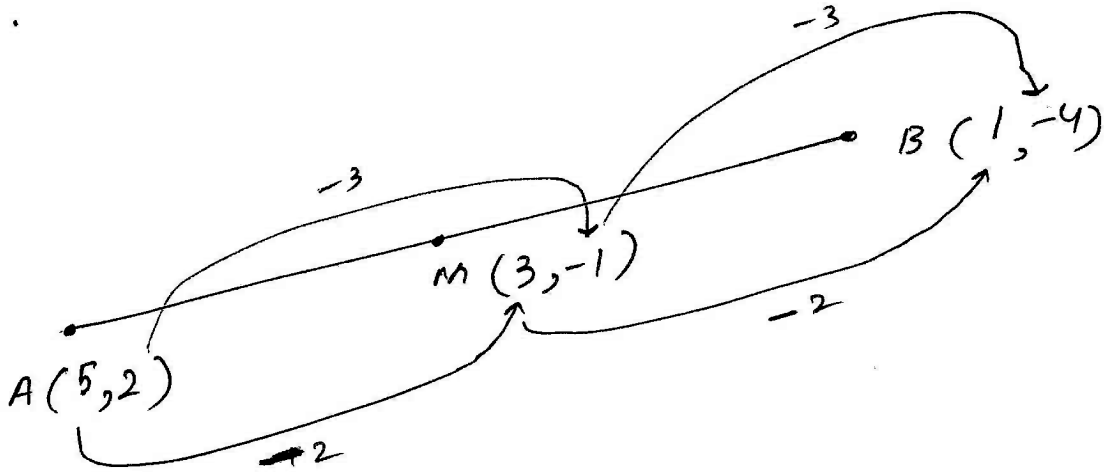
$$\text{Mid point} = \left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

① find mid point of  $(3, 8)$   $(5, -6)$

$$\begin{aligned} M &= \frac{3+5}{2}, \frac{8+(-6)}{2} \\ &= (4, 1) \end{aligned}$$

Finding End point: ③

$M(3, -1)$  is the Mid-point of  
 $A(5, 2)$  &  $B$ . find coordinates  
of  $B$ .



Other way:-

$$\frac{x_1 + x_2}{2} = 3$$

$$\frac{5 + x_2}{2} = 3$$

$$5 + x_2 = 6$$

$$x_2 = 6 - 5$$

$$x_2 = 1$$

$$\frac{y_1 + y_2}{2} = -1$$

$$\frac{2 + y_2}{2} = -1$$

$$2 + y_2 = -2$$

$$y_2 = -2 - 2$$

$$y_2 = -4$$

③ Gradient (m)

④

Steepness

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

Rise  
Run

positive

negative

About gradients

i) if a line is horizontal

$$\text{grad} = 0$$

$$m = 0$$

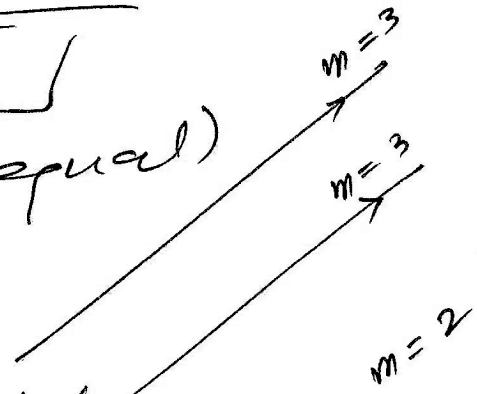
ii) if a line is vertical

gradient = undefined

$$m = \infty$$

$$m = \frac{1}{0}$$

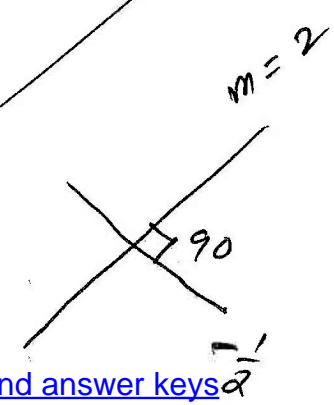
iii) if two parallel lines  
same gradient (equal)  
 $m_1 = m_2$



iv) if two lines are perpendicular  
at  $90^\circ$

$$m_1 \times m_2 = -1$$

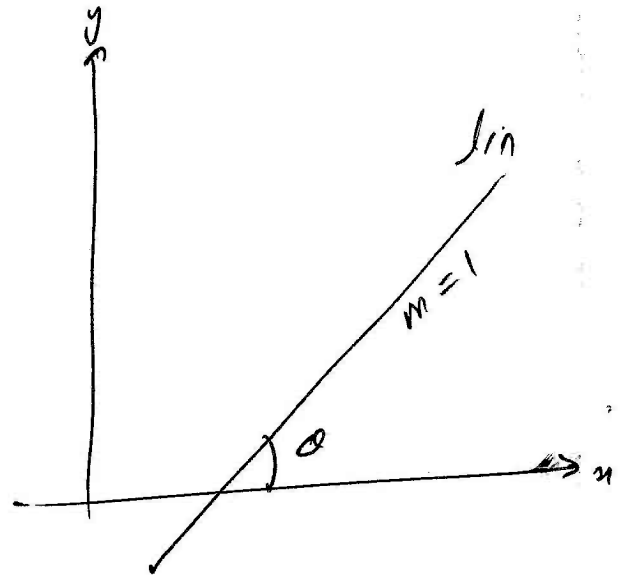
$$m_2 = -\frac{1}{m_1}$$



④ Angle of a line <sup>⑤</sup> with x-axis  
if gradient =  $m$

$$\tan \theta = m$$

$$\theta = \tan^{-1}(m)$$



Angle  
 $\theta = \tan^{-1}(1)$

$$\theta = 45^\circ$$

find gradient : A(-3, 8) B(5, 8)  
①

$$m = \frac{8 - 8}{5 - -3} = \frac{0}{8}$$

horizontal = 0

# \* Equation of Straight line :

$$y = mx + c$$

↓
↓  
 gradient                  y-intercept.

To find equation of a line

We need

- (i) gradient = m
- (ii) y-intercept = c

Note :

y

must be the subject,  
 then coefficient of  $x$  is gradient  
 (then before  $x$ )

$$y = 3x + 2$$

$m = 3$

$$y = 4 - x$$

$m = -1$

$$2y = x + 6$$

$$y = \left(\frac{1}{2}\right)x + \frac{6}{2}$$

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

$$3x + 2y = 6$$

$$2y = 6 - 3x$$

$$y = \frac{6 - 3x}{2}$$

$$3 - \frac{3}{2}x$$

$m = -\frac{3}{2}$

① find equation <sup>⑦</sup> of line through  
(6, -1) & gradient 2

$$\begin{array}{l} (x \quad y) \\ (6, -1) \end{array} \quad m = 2$$

$$y = mx + c$$

$$-1 = 2(6) + c$$

$$-1 = 12 + c$$

$$-1 - 12 = c$$

$$\boxed{c = -13}$$

$$\boxed{y = 2x - 13}$$

find equation of line through  $(-2, 8)$   
&  $(5, -6)$

$$m = ?$$

$$c = ?$$

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

$$m = \frac{-6 - 8}{5 - (-2)} = \frac{-14}{7} = -2$$

$$(-2, 8)$$

$$y = mx + c$$

$$8 = -2(-2) + c$$

$$8 = 4 + c$$

$$\boxed{y = -2x + 4}$$

$$\begin{array}{l} 8 - 4 = c \\ \boxed{4 = c} \end{array}$$

find gradient of <sup>(8)</sup> line through  $(5, -7)$   
& parallel to  $3x + 2y = 6$

$$2y = 6 - 3x$$

$$y = \frac{6}{2} - \frac{3}{2}x$$

$$\boxed{m = -\frac{3}{2}} \text{ equal.}$$

$(5, -7)$

$$m = ?$$

$$c = ?$$

$$y = mx + c$$

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

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

↖  
⊕

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

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

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



find equation of <sup>⑨</sup> line through  
mid-point of  $(3, 4)$  &  $(1, -2)$   
& perpendicular to  $y = \underline{3x + 6}$

$$m_1 = 3$$

$$m = \checkmark$$

for  $\perp$

$$m_2 = -\frac{1}{m_1}$$

$$c =$$

$$m_2 = -\frac{1}{3}$$

mid

$$\frac{3+1}{2}, \quad \frac{4+(-2)}{2}$$

$$\begin{matrix} (2, 1) \\ x \quad y \end{matrix}$$

$$y = mx + c$$

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

$$1 = -\frac{2}{3} + c$$

$$1 + \frac{2}{3} = c$$

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

$$y = mx + c$$

$$y = -\frac{1}{3}x + \frac{5}{3}$$

# Perpendicular Bisector

at 90°

through Mid point

$$m_2 = -\frac{1}{m_1}$$

$$\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}$$

find equation of perp bisector of  
(3, 5) (-2, -1)

$$m_1 = \frac{-1 - 5}{-2 - 3}$$

$$m_1 = \frac{-6}{-5}$$

$$m_1 = \frac{6}{5}$$

$$m_2 = -\frac{1}{\left(\frac{6}{5}\right)}$$

$$m_2 = -\frac{5}{6}$$

$$\frac{3 + (-2)}{2}, \frac{5 + (-1)}{2}$$

$$\left(\frac{1}{2}, 2\right)$$
  
x y

$$y = mx + c$$

$$2 = -\frac{5}{6}\left(\frac{1}{2}\right) + c$$

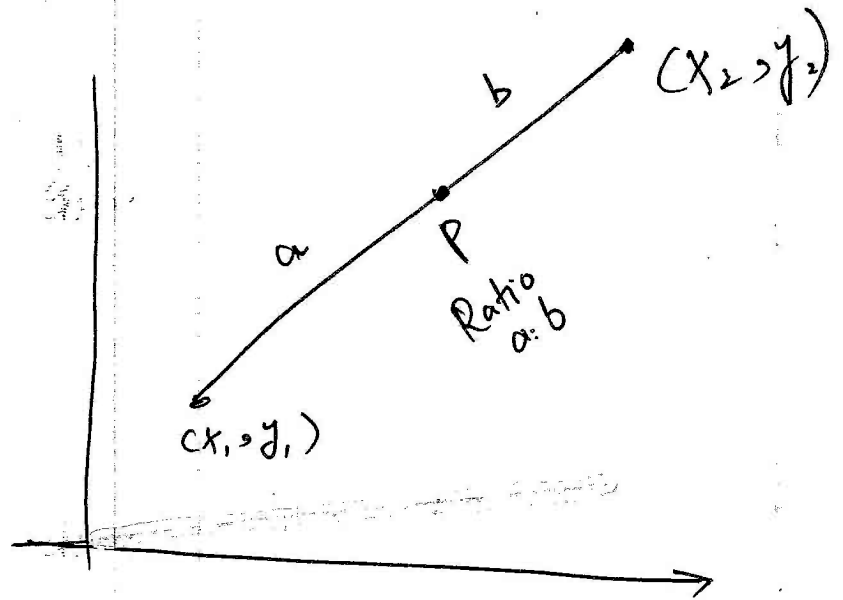
$$2 = -\frac{5}{12} + c$$

$$2 + \frac{5}{12} = c$$

$$\frac{29}{12} = c$$

$$y = -\frac{5}{6}x + \frac{29}{12}$$

②  
A point dividing a line segment  
in  $a:b$



$P(x, y) =$

$$x = \frac{bx_1 + ax_2}{a+b} \quad , \quad y = \frac{by_1 + ay_2}{a+b}$$

ex: Point P lies on line joining  
A(4, -6) & B(8, 3) such that  
AP:PB = 2:1. find coordinates of P.

Solution

A(4, -6)	B(8, 3)
$x_1, y_1$	$x_2, y_2$

Ratio:  $a:b = 2:1$

$$x = \frac{1(4) + 2(8)}{1+2} \quad y = \frac{1(-6) + 2(3)}{2+1}$$

$$= \frac{12}{3}$$

$$y = \frac{0}{3}$$

$$x = 4$$

$$y = 0$$

$$\implies P(4, 0)$$