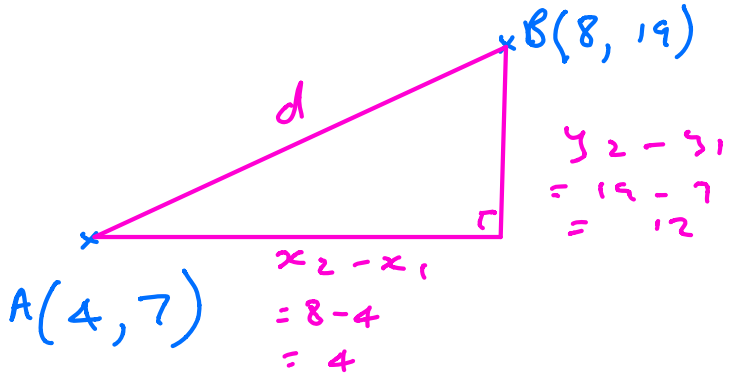
Distance Between Two Points

Ex 1



Pythagoras

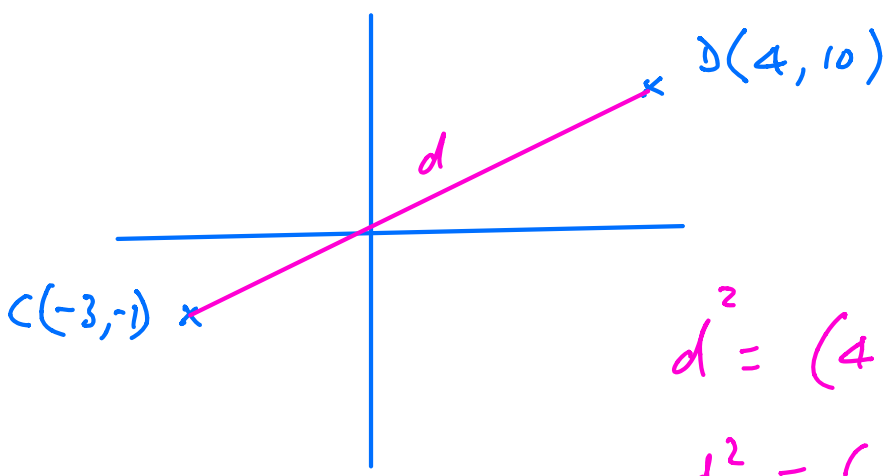
$$d^2 = 4^2 + 12^2$$

$$d^2 = 160$$

$$d = \sqrt{160}$$

$$d = 12.6 \text{ units}$$

Ex



$$d^2 = (4 - -3)^2 + (10 - -1)^2$$

$$d^2 = (4+3)^2 + (10+1)^2$$

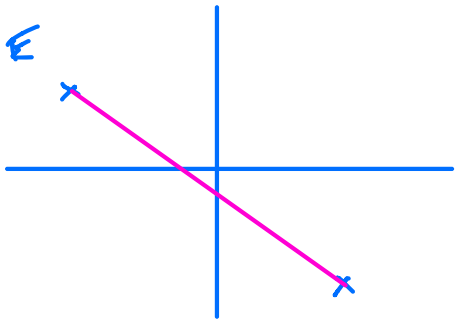
$$d^2 = 7^2 + 11^2$$

$$d^2 = 170$$

$$d = \sqrt{170}$$

$$d = 13.0 \text{ units}$$

Ex 3 Find distance between $E(-8, 4)$ and $F(5, -6)$



$$d^2 = (5 - -8)^2 + (-6-4)^2$$
$$d^2 = (5+8)^2 + (-6-4)^2$$
$$d^2 = 13^2 + (-10)^2$$
$$d^2 = 269$$
$$d = \sqrt{269}$$
$$d = 16.4 \text{ units}$$

Exercise Find the distances between these pairs of points

1) $A(9, 1)$ and $B(3, 5)$

$d^2 = (3-9)^2 + (5-1)^2$
$= (-6)^2 + 4^2 = 52$

$d = \sqrt{52}$
$d = 7.21$ units

2) $C(-4, 4)$ and $D(-11, -3)$

$d^2 = (-11 - -4)^2 + (-3-4)^2$
$= (-7)^2 + (-7)^2 = 98$

$d = \sqrt{98}$
$d = 9.90$ units

3) $E(-1, 6)$ and $F(8, 14)$

$d^2 = (8 - -1)^2 + (14-6)^2$

$= 9^2 + 8^2 = 145$ $\quad d = \sqrt{145}$

$d = 12.0$

4) $G(-3,-5)$ and $H(-8,-1)$

$d^2 = (-8 - -3)^2 + (-1 - -5)^2$

$= (-5)^2 + (4)^2 = 41$ $\quad d = \sqrt{41}$

$d = 6.40$

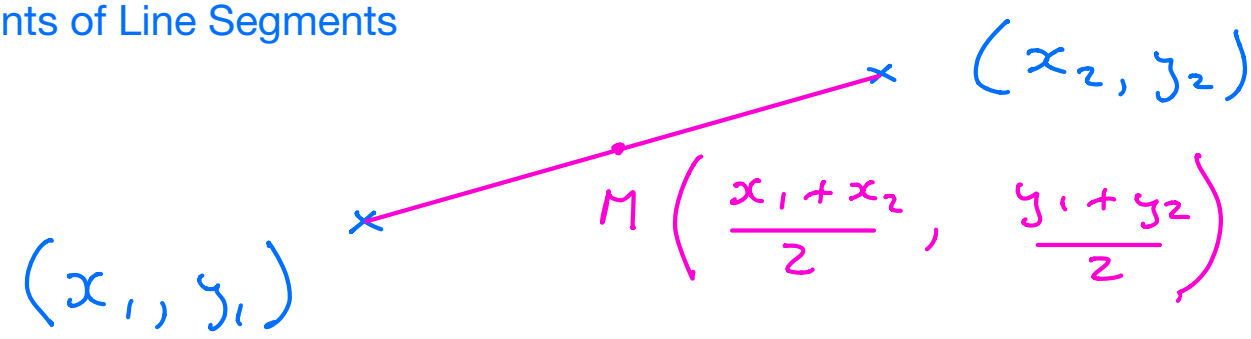
5) $I(6,-1)$ and $J(-5,12)$

$d^2 = (-5-6)^2 + (12 - -1)^2$

$= (-11)^2 + (13)^2 = 290$ $\quad d = \sqrt{290}$

$d = 17.0$

Midpoints of Line Segments



Ex1 Find midpoint of $(4,7)$ and $(6,13)$

$$\text{Midpoint} = \left(\frac{4+6}{2}, \frac{7+13}{2}\right) = (5, 10)$$

Exercise Find midpoints of pairs of points in previous exercise

1) $A(9,1)$ and $B(3,5)$

$$M\left(\frac{9+3}{2}, \frac{1+5}{2}\right) = \left(\frac{12}{2}, \frac{6}{2}\right) = (6,3)$$

2) $C(-4,4)$ and $D(-11,-3)$

$$M\left(\frac{-4+-11}{2}, \frac{4+-3}{2}\right) = \left(\frac{-15}{2}, \frac{1}{2}\right)$$

3) $E(-1,6)$ and $F(8,14)$

$$M\left(\frac{-1+8}{2}, \frac{6+14}{2}\right) = \left(\frac{7}{2}, \frac{20}{2}\right) = \left(\frac{7}{2}, 10\right)$$

4) $G(-3,-5)$ and $H(-8,-1)$

$$M\left(\frac{-3+-8}{2}, \frac{-5+-1}{2}\right) = \left(-\frac{11}{2}, -\frac{6}{2}\right) = \left(-\frac{11}{2}, -3\right)$$

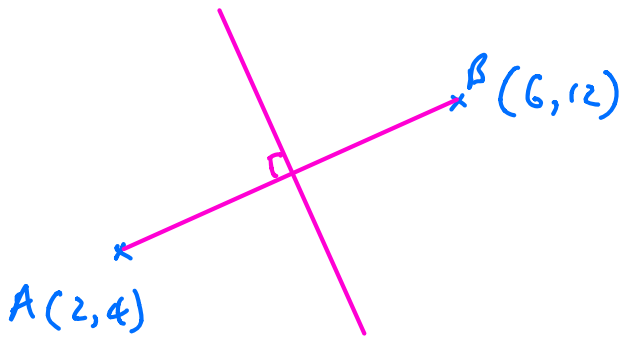
5) $I(6,-1)$ and $J(-5,12)$

$$M\left(\frac{6+-5}{2}, \frac{-1+12}{2}\right) = \left(\frac{1}{2}, \frac{11}{2}\right)$$

Finding the equation of a perpendicular bisector

Find perpendicular bisector between points

$A(2,4)$ and $B(6,12)$



Gradient of AB

$$= \frac{y_2 - y_1}{x_2 - x_1} = \frac{12-4}{6-2}$$

$$= \frac{8}{4}$$

$$= 2$$

$\perp$ gradient $= -\frac{1}{2}$

Midpoint of AB

$$= \left(\frac{2+6}{2}, \frac{4+12}{2}\right) = (4, 8)$$

Find eqn of line through $(4,8)$ with gradient $= -\frac{1}{2}$

$$y = -\tfrac{1}{2}x + c$$

Sub $(4,8)$

$$8 = -\tfrac{1}{2}(4) + c$$

$$8 = -2 + c$$

$$8 + 2 = c$$

$$10 = c$$

$$\underline{y = -\tfrac{1}{2}x + 10}$$