# Mathematics 10D

## 2.2 – Length of a Line Segment

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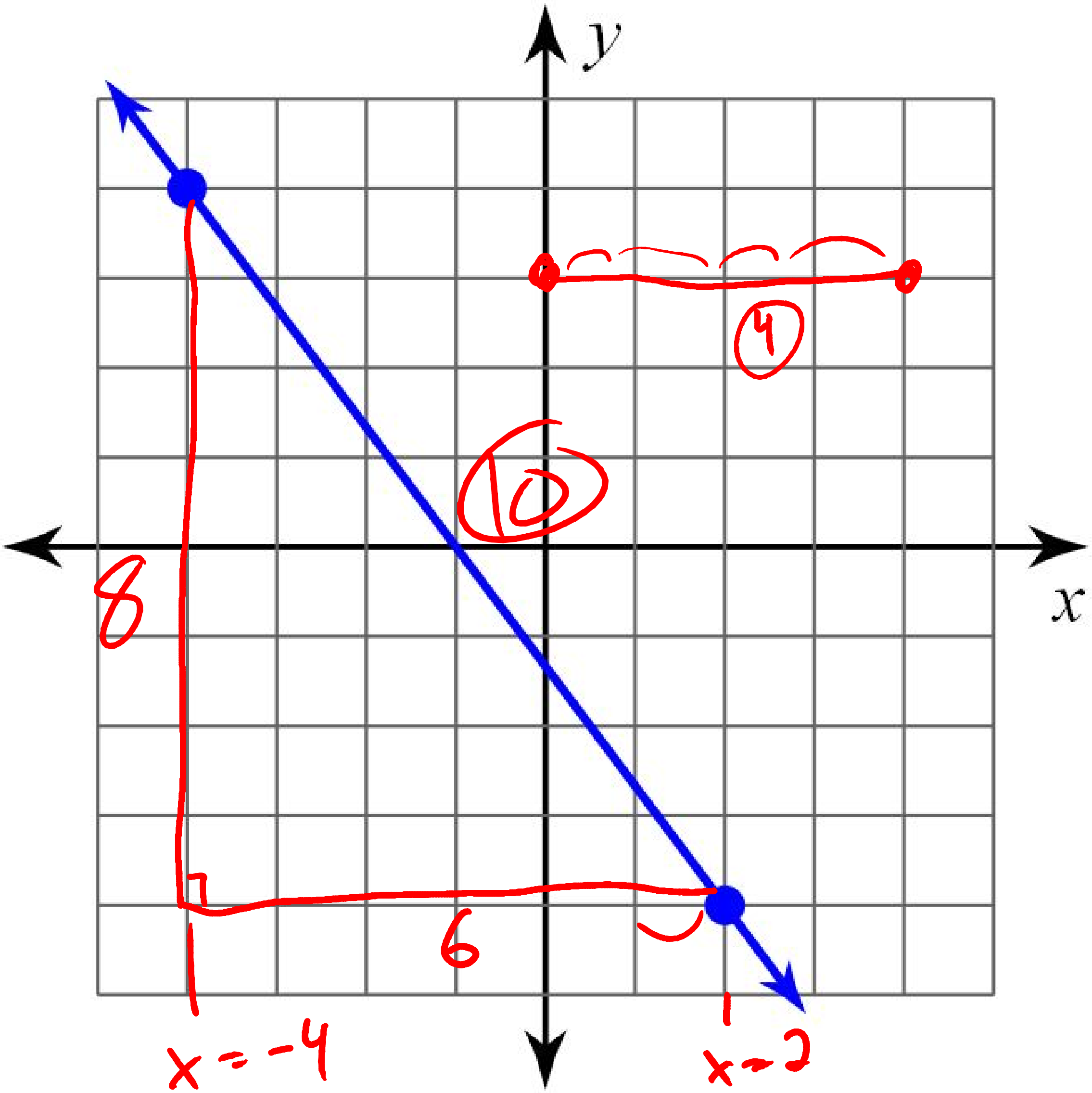
Find the distance between the two points:




$-4 - 2 = -6$

$c^2 = a^2 + b^2$

$c^2 = 6^2 + 8^2$

$c^2 = 36 + 64$

$c^2 = 100$

$c = 10$

Let's derive the Distance Formula:

$$c^2 = a^2 + b^2$$

Let $a = x$'s

$b = y$'s

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

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

Find the distance between the two given points:

$(8, 6), (-2, -7)$

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

$$d = \sqrt{(-2-8)^2 + (-7-6)^2}$$

$$d = \sqrt{100 + 169}$$

$$d = \sqrt{269}$$

$$d = 16.4$$

$(18, -2), (-17, 4)$

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

$$d = \sqrt{(-17-18)^2 + (4 - -2)^2}$$

$$d = \sqrt{(-35)^2 + (6)^2}$$

$$d = \sqrt{1225 + 36}$$

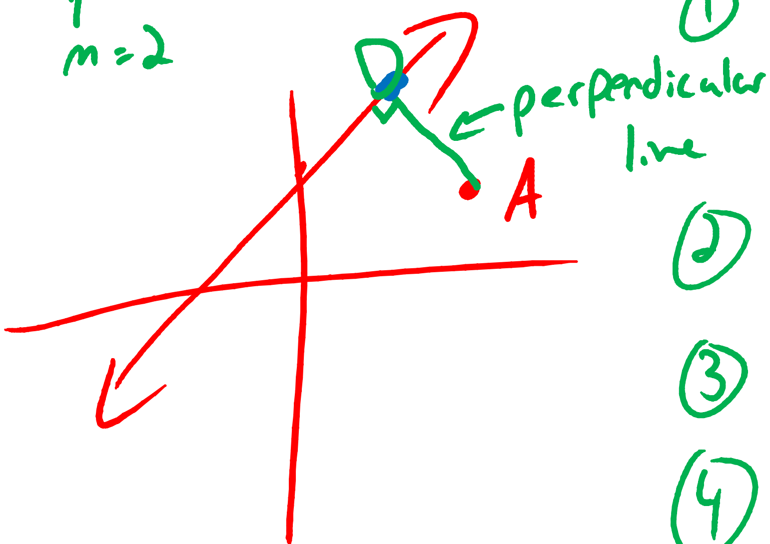
$$d = \sqrt{1261} = 35.5$$

$\cancel{-35^2 = 1225}$

$(-35)^2 = 1225$

The Big Question: Calculate the shortest distance from point A(6,5) and the line $y=2x+3$.

$\uparrow$
$m=2$




① find $m_\perp$

② find $y = m_\perp x + b$ using A

③ find PoI of original and new line

④ Calculate distance.

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① $m=2$

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

② $y = mx+b$

$5 = \frac{-1}{2}(6)+b$

$5 = -3 + b$

$8 = b$

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

③ $\left(2x+3 = \frac{-1}{2}x+8\right)2$

$4x+6 = -1x+16$

$5x = 10$

$x = 2$

$\therefore y = 2(2)+3$

$y = 7$

$\therefore$ PoI is $(2,7)$

or point D is $(2,7)$

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

$d_{AD} = \sqrt{(2 - 6)^2 + (7 - 5)^2}$

$d_{AD} = \sqrt{16 + 4}$

$d_{AD} = \sqrt{20}$

$d_{AD} = 4,5$

Let's Do Another!: Calculate the shortest distance from point B(-2,-3) and the line $y = -\frac{2}{5}x + 6$

① $m = \frac{-2}{5}$

$m_{\perp} = \frac{5}{2}$

② $y = mx + b$

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

$-3 = -5 + b$

$2 = b$

$\therefore y = \frac{5}{2}x + 2$

③ $\left(\frac{5}{2}x + 2 = \frac{-2}{5}x + 6\right)10$

$25x + 20 = -4x + 60$

$29x = 40$

$x = 1.4$

$y = \frac{5}{2}(1.4) + 2$

$y = 5.5$

$\therefore$ PoI $(1.4, 5.5)$ D

④ $d_{AD} = \sqrt{(1.4 - -2)^2 + (5.5 - -3)^2}$

$d_{AD} = \sqrt{11.56 + 72.25}$

$d_{AD} = \sqrt{83.81} = 9.15$