

Unit 3: Distance Formula

(a tip!)
↳ a formula to find

the distance (length) between two points.

e.x. x y
 $P_1(2, 1)$

$P_2(5, 1)$

What's the distance between the two points?
3 units

Find the distance:

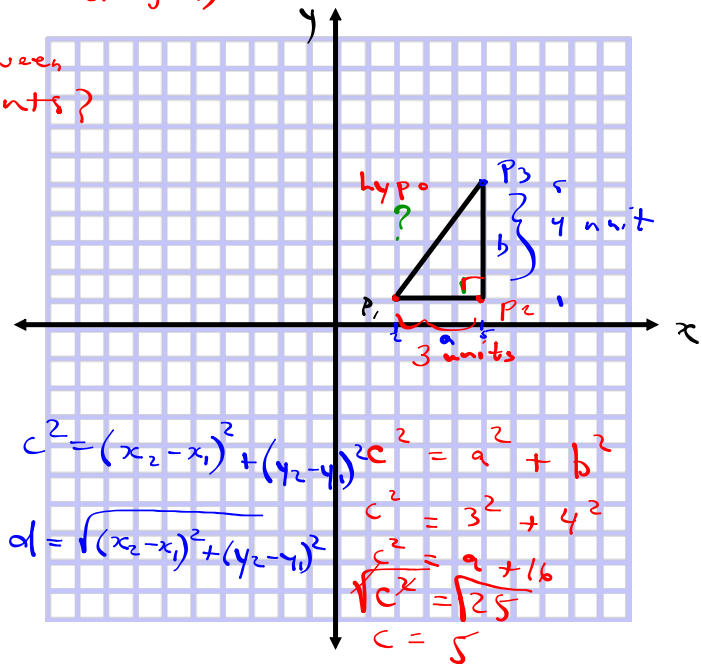
$P_2(5, 1)$

$P_3(5, 5)$

Find the distance:

$P_1(2, 1)$

$P_3(5, 5)$



Distance Formula

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

$$P_1 (x_1, y_1)$$

$$P_2 (x_2, y_2)$$

e.x. What's the distance

between

$$P_1 \quad x_1 \quad y_1$$

$$A (-2, 5)$$

$$P_2 \quad x_2 \quad y_2$$

$$B (3, 2)$$

• LABEL

• Write out
the distance
formula
• Point

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

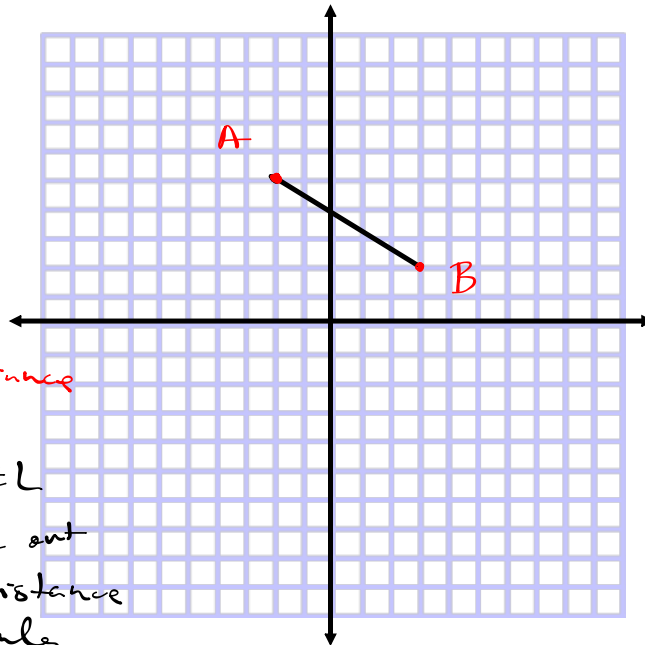
$$d = \sqrt{((3 - (-2))^2 + (2 - 5)^2)}$$

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

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

$$d = \sqrt{34}$$

$$d = 5.83 \text{ units}$$



On a map, the Sports Centre is located at point $(-1, -1)$. The Art Building is located at point $(3, 6)$. If each unit represents 1.5 miles, what's the distance between the two buildings?
in miles.

$$d = 8.06 \text{ unit}$$

$$d = 8.06 \times 1.5 \text{ miles}$$

$$d = 12.09 \text{ miles}$$

Good Exam Question:

Voici une forêt québécoise dangereuse.

You need to go from
Campsite A to
Campsite C.
What distance
will you travel?

$A(-3, -3)$
 $B(2, 4)$

$A(-3, -3)$

$B(2, 4)$

You're at campsite
B and you want
to go to campsite C.
However you need
to first get your
water bottle (cause
you have coffee
breath) from campsite
A.
What distance
will you travel?

$B(2, 4)$
 $C(4, -4)$

$C(4, -4)$

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

$$d_{AB} = \sqrt{((2 - (-3))^2 + (4 - (-3))^2)}$$

$$d_{AB} = 8.60 \text{ units}$$

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

$$d_{BC} = 8.25 \text{ units}$$

$$\begin{aligned} d_{\text{total}} &= d_{AB} + d_{BC} \\ &= 8.60 + 8.25 \\ &= 16.85 \text{ units} \end{aligned}$$

$$\begin{aligned} d_{\text{Total}} &= d_{AB} + d_{AB} + d_{BC} \\ &= 8.60 + 8.60 + 8.25 \\ &= \underline{25.45 \text{ units}} \end{aligned}$$

Exam type question:

The following expressions represent distances between two points.

1) $\sqrt{((1+5)^2 + (1-4)^2)}$

2) $\sqrt{(3-5)^2 + (-2+4)^2}$

3) $\sqrt{(-2-4)^2 + (3+5)^2}$

4) $|3 + 5|$

5) $\sqrt{(1-3)^2 + (1+2)^2}$

→ (absolute value only used for points on a horizontal or vertical line)

A (x_1, y_1)

B (-2, 3)

C (x_2, y_2)

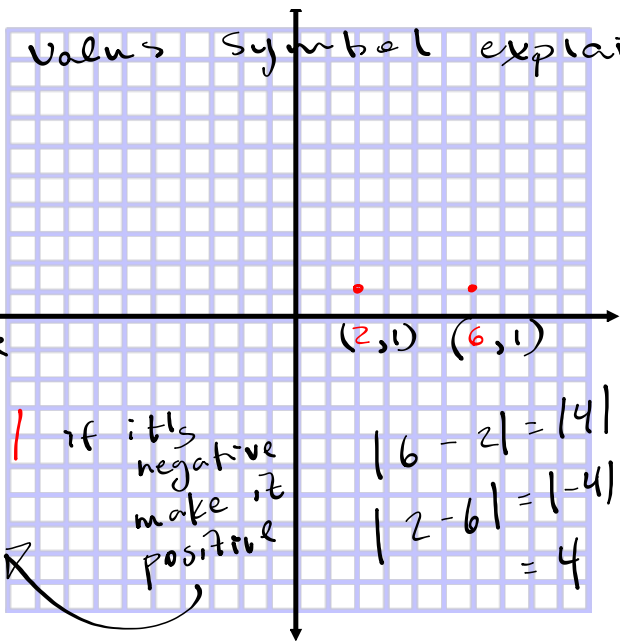
Determine which expression corresponds to the distance of each segment

\overline{AB} _____

\overline{AC} _____

\overline{BC} _____

Absolute Value Symbol explained.



$6 - 2 = 4$
absolute value

$|2 - 6| = |-4|$
 $= 4$

if it's
negative
make it
positive

$|6 - 2| = |4| = 4$
 $|2 - 6| = |-4| = 4$
 $|4| = 4$
 $|-4| = 4$

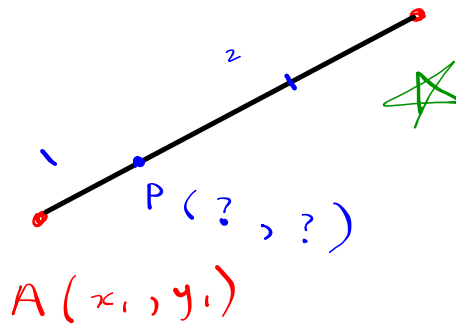
Unit 4: Coordinates of a Point of Division

$$P \left(\frac{bx_1 + ax_2}{b+a}, \frac{by_1 + ay_2}{b+a} \right)$$

Division ratio

$$r = \frac{a}{b}$$

$$\frac{1}{2}$$



$B(x_2, y_2)$
 P divides \overline{AB}
 in a ratio
 of $1:2 \left\{ \frac{1}{2} \right\}$.
 P is located
 $\frac{1}{3}$ along
 \overline{AB} .

Find the coordinates of point P that divides \overline{ST} in a ratio of $\frac{1}{3}$ $\begin{matrix} a \\ b \end{matrix}$

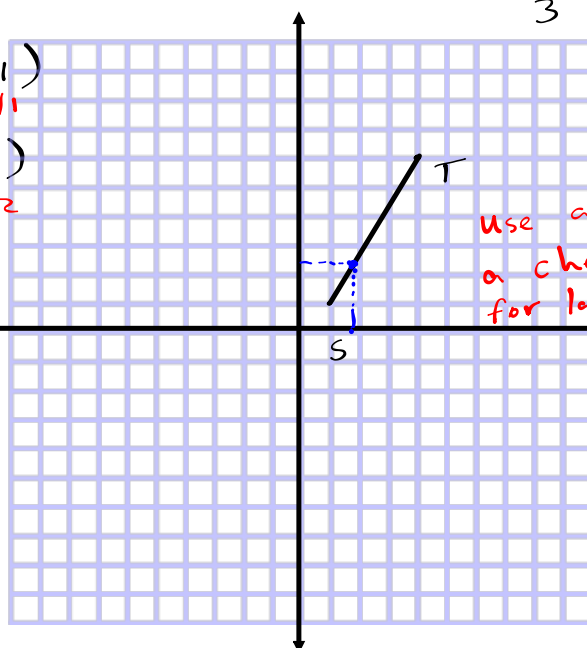
where $S(x_1, y_1)$

$T(x_2, y_2)$

$$P\left(\frac{bx_1 + ax_2}{b+a}, \frac{by_1 + ay_2}{b+a}\right)$$

$$P\left(\frac{7}{4}, \frac{9}{4}\right)$$

$$(1.75, 2.25)$$

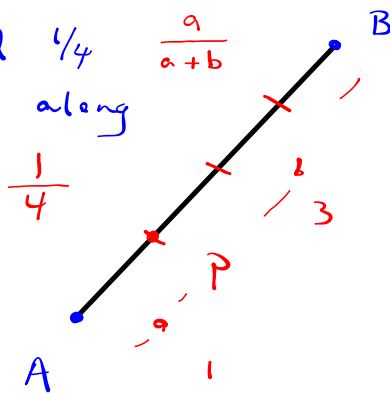


Use as
a check
for later!

Location Ratio vs Division Ratio

P is located $\frac{1}{4}$ of the way along AB.

P is $\frac{1}{4}$ of the way along AB.



↳ the ratio we use for the formula!

Ask yourself how does P divide AB.

P divides AB

$$\underline{1 : 3} \quad \frac{1}{3} \quad \frac{a}{b}$$

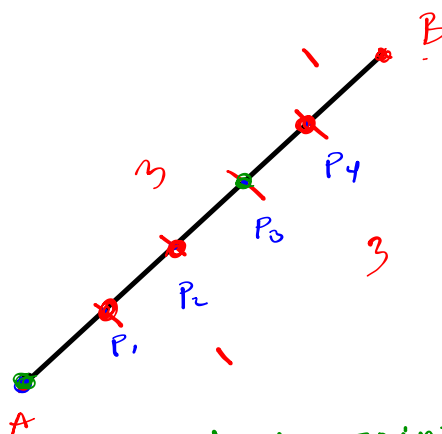
Location Ratio to Division Ratio

- D.R. has same numerator as L.R.
- D.R.'s denominator is L.R.'s den minus L.R.'s numerator.

| L.R | D.R |
|---------------|-----------------|
| $\frac{2}{3}$ | $\frac{2}{1}$ |
| $\frac{1}{6}$ | $\frac{1}{7}$ |
| $\frac{3}{4}$ | $\frac{3}{1}$ |
| $\frac{1}{3}$ | $\frac{1}{2}$ |
| $\frac{4}{5}$ | $\frac{4}{1}$ |
| $\frac{1}{2}$ | $\frac{1}{1}$ |
| $\frac{2}{5}$ | $\frac{2}{3}$ |
| $\frac{5}{8}$ | $\frac{5}{3}$ |
| $\frac{3}{4}$ | $\frac{3}{1}$ |
| $\frac{3}{5}$ | $\frac{3}{2}$ |
| $\frac{3}{i}$ | $\frac{3}{i-3}$ |
| $\frac{2}{3}$ | $\frac{2}{1}$ |
| $\frac{1}{4}$ | $\frac{1}{3}$ |

Exam Question:

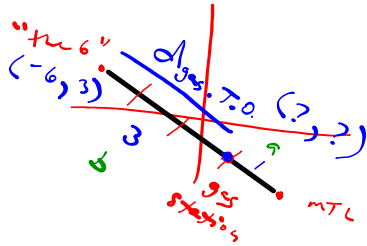
- Which point is $\frac{2}{5}$ along \overline{AB} ?
 $P_2!$
- Which point is $\frac{2}{5}$ along \overline{BA} ?
 $P_3!$
- Which point is $\frac{2}{3}$ along $\overline{AP_3}$?
 P_2



Which point divides $\overline{BP_1}$ in a ratio of $\frac{1}{3}$? P_4

You live in Montréal \heartsuit $(5, -4)$, and you decide to take a road trip to Toronto $(-6, 3)$ (God only knows why!).

You stop to get gas $1/4$ of the way there. How much distance do you have left to travel if one unit represents 26 km?



- Game Plan
- Confidence
- Read/Reread/Understand
- Draw a Pic sketch.
- Label. check.

$$P \left(\frac{bx_1 + ay_2}{b+a}, \frac{by_1 + ax_2}{b+a} \right)$$

$$P(2.25, -2.25)$$

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

$$= 9.77 \text{ unit}$$

$$= \frac{9.77 \text{ unit}}{1} \times 26 \text{ km}$$

$$= 254.25 \text{ km.}$$

$$d_{MTL/T.O.} = \frac{13.04}{4} = 3.2596 \text{ units} \times 3$$

$$= 9.7788 \times 26$$

