Student Name

Mathematics Stage 5 Paths

LINEAR RELATIONSHIPS C

Book 2 Apply the distance formula to find the distance between 2 points located on the Cartesian plane

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CONTENTS

OVERVIEW

SYLLABUS CONTENT

MA5-LIN-P-01 describes and applies transformations, the midpoint, gradient/slope and distance formulas, and equations of lines to solve problems

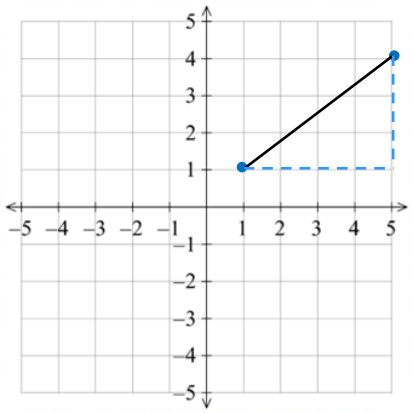
Apply the distance formula to find the distance between 2 points located on the Cartesian plane

- Apply knowledge of Pythagoras' theorem to establish the formula for the distance (d) between the 2 points $(x_1,\ y_1)$ and (x_2, y_2) on the Cartesian plane: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Apply the distance formula to find the distance between 2 points on the Cartesian plane

REVIEW OF PRIOR KNOWLEDGE

1 Using Pythagoras' theorem, calculate the length of these intervals.

a $(1,1)$ and $(5,4)$



Rise .....

Run .....

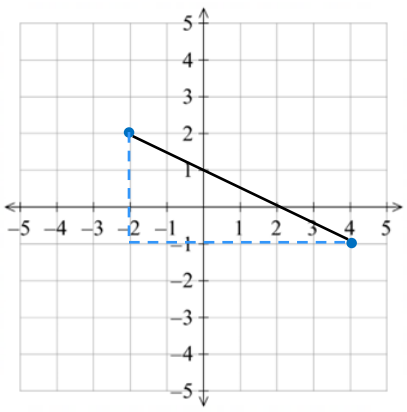
$d^2 =$ ..... + ...

$=$ .....

$d =$ .....

$=$ .....

b $(-2,2)$ and $(4,-1)$



Rise .....

Run .....

$d^2 =$ ..... + ...

$=$ .....

$d =$ .....

$=$ .....

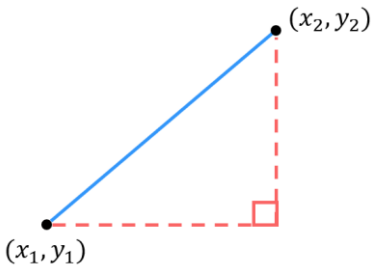
DISTANCE FORMULA

Distance Formula

For two coordinates (x_1, y_1) and (x_2, y_2):

$$d = \sqrt{\text{run}^2 + \text{rise}^2}$$

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



Example Calculate distance using the formula.

Calculate the distance of the interval through these points. Answer as a surd and to 2 d.p.

$(2,6)$ and $(5,1)$

$x_1\ y_1 \qquad x_2\ y_2$

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$
$$= \sqrt{(5-2)^2 + (1-6)^2}$$
$$= \sqrt{34}$$
$$\approx 5.83$$

$(-3,5)$ and $(6,-4)$

$x_1\ y_1 \qquad x_2\ y_2$

$$d = \sqrt{(6-(-3))^2 + (-4-5)^2}$$
$$= \sqrt{(9)^2 + (-9)^2}$$
$$= \sqrt{162}$$
$$\approx 12.73$$

Calculate the length of the interval between these points. Answer as a surd and to 2 d.p.

a $(-2,3)$ and $(5,4)$

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

$5\sqrt{2}$ or 7.07

b $(0,4)$ and $(3,6)$

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

$\sqrt{13}$ or 3.61

c $(-3,4)$ and $(2,4)$

5

d $(1,-2)$ and $(-4,3)$

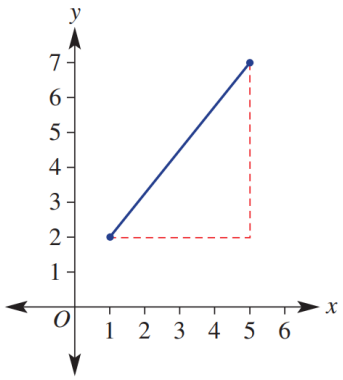
$5\sqrt{2}$ or 7.07

Key ideas

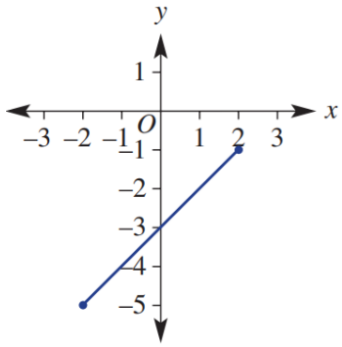
1. The distance between two points is calculated using ……’s theorem.

1 Calculate the length of the line segment.

a



b



2 Explain where the distance formula $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ comes from.

.....

.....

3 Find the length, or distance, of each interval.

a A(1, 4), B(5, 1)

b A(−2, 7), B(3, −5)

c A(−5, −2), B(3, 4)

d A(3, 6), B(5, 4)

e A(−4, −1), B(4, 3)

f A(5, −12), B(0, 0)

4 Find the values of a and b when distance between:

a $(1, a)$ and $(3,5)$ is $\sqrt{8}$.

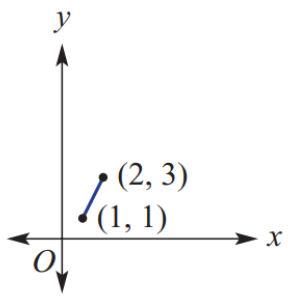
b $(2, a)$ and $(5,1)$ is $\sqrt{13}$.

c $(a, -1)$ and $(4, -3)$ is $\sqrt{29}$.

d $(-3, -5)$ and $(a, -9)$ is 5.

5 Calculate the length, gradient, and midpoint of each line segment AB.
Give your answers to 1 decimal place.

a



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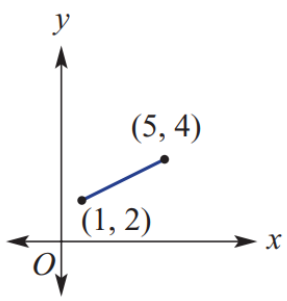
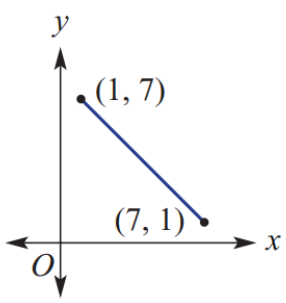
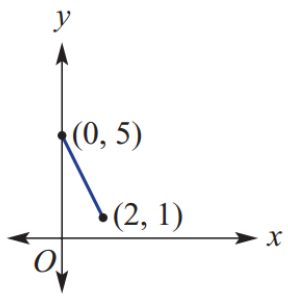


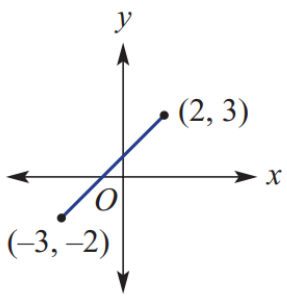
c



d



e



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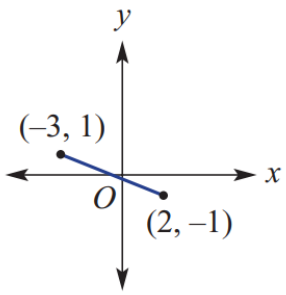
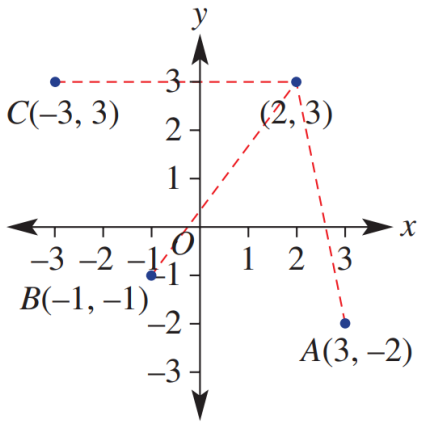
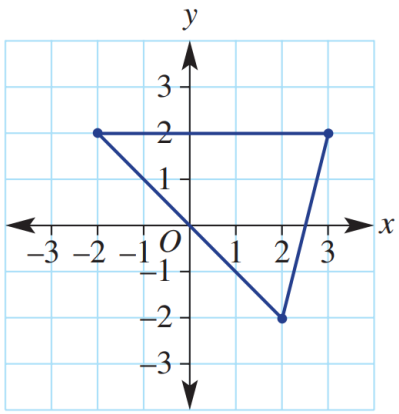


6 Which of the points A, B or C shown is closest to (2,3)?



7 A block of land is illustrated on this simple map, which uses the ratio 1:100, meaning that 1 unit represents 100 m. Find the perimeter of the block, correct to the nearest metre.



8 Points A, B and C lie on a straight line.
Point A has coordinates $(-4, 1)$
Point B has coordinates $(7, -5)$
Point C is such that $AB : BC = 4 : 7$.
Work out the length of line segment AC. Give your answer to 1 decimal place.