

Midpoint and length of a line segment

Year 9
Mathematics

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Learning Objectives

By the end of the lesson I hope that you understand and can apply the following to a range of questions from the Year 9 Mathematics course.

- To be able to find the midpoint of a line segment
- To be able to find the length of a line segment.
- Understand how to use Pythagoras' Theorem



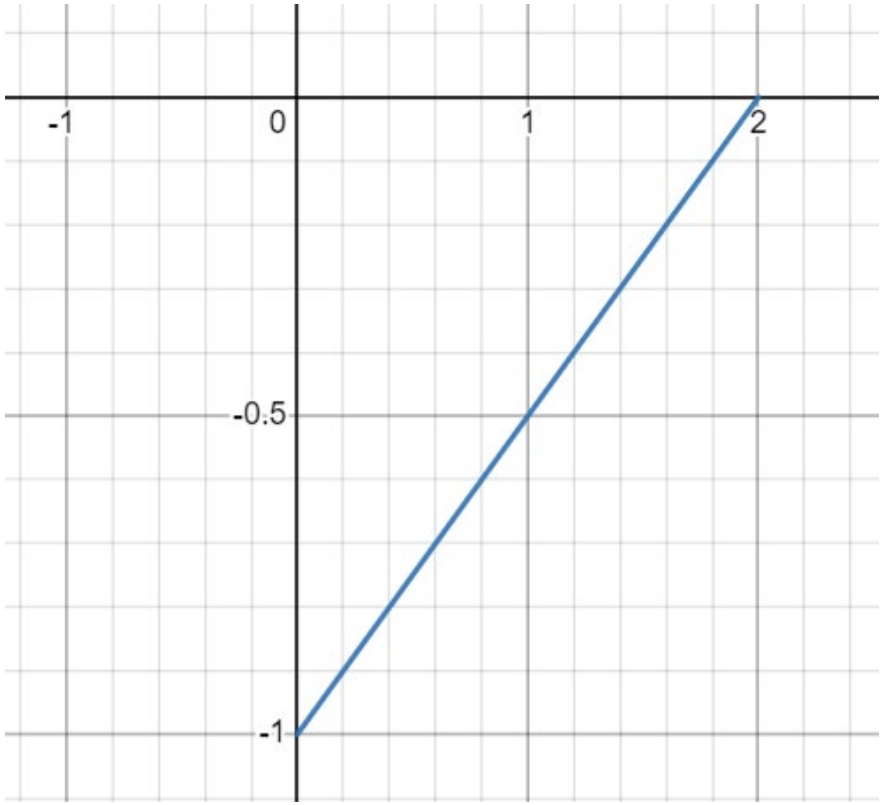
RECAP

We have so far been looking at how to draw straight lines. Straight lines are in every section of the course from now until you stop doing Maths.

Being able to sketch them are really important. Then we need to know how to find the length of parts of the lines.

It makes sense that we can't find the length of a whole line!!!! We can find the length of a line **segment**.

A segment is a **part of a line**. It makes sense that a line segment has a start coordinate and end coordinate.

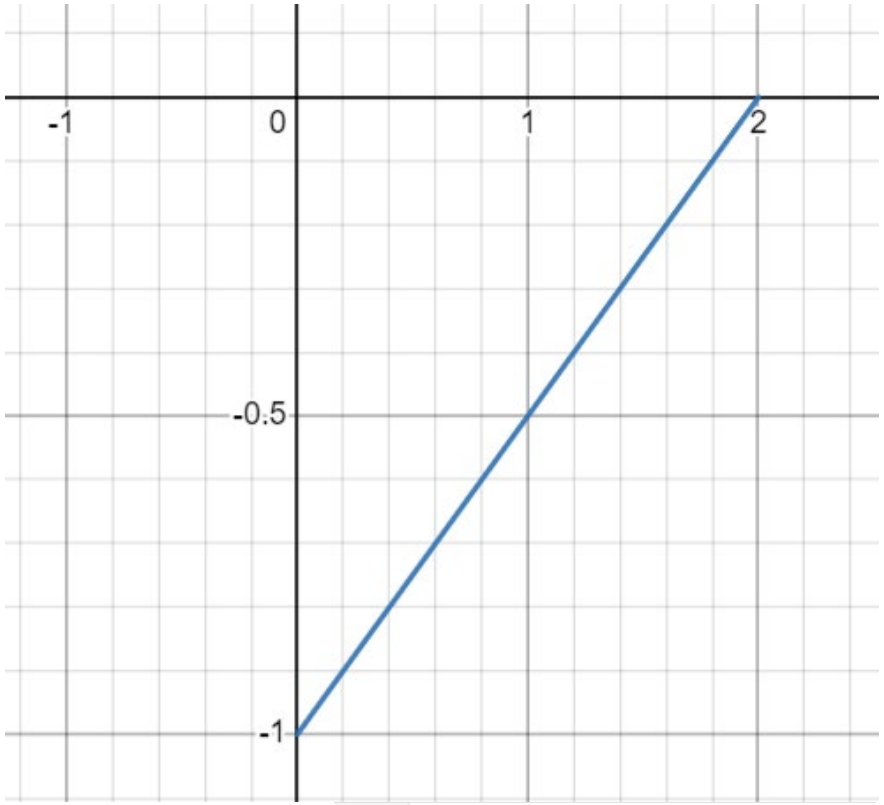


$y = mx + c$



Drawing a line segment in Desmos

If ever you feel the need, you can use Desmos.com to draw parts of lines. You just need to know the correct **syntax.**



$y = \frac{1}{2}x - 1\{0 \leq x \leq 2\}$



Finding the midpoint of a line segment

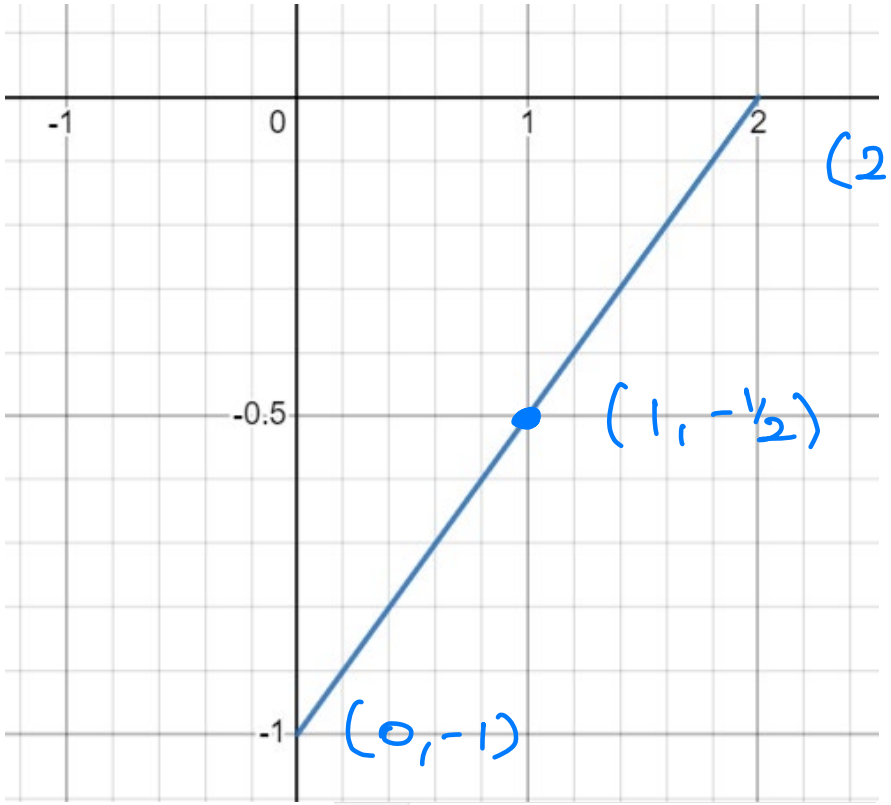
Doing this from a sketch is pretty easy.

Can you visually see where the midpoint of the line segment is?

The midpoint is the middle of the line.

(0, -1) (2, 0)

$(1, -\frac{1}{2})$



1 $y = \frac{1}{2}x - 1 \{0 \leq x \leq 2\}$



Finding the midpoint of a line segment

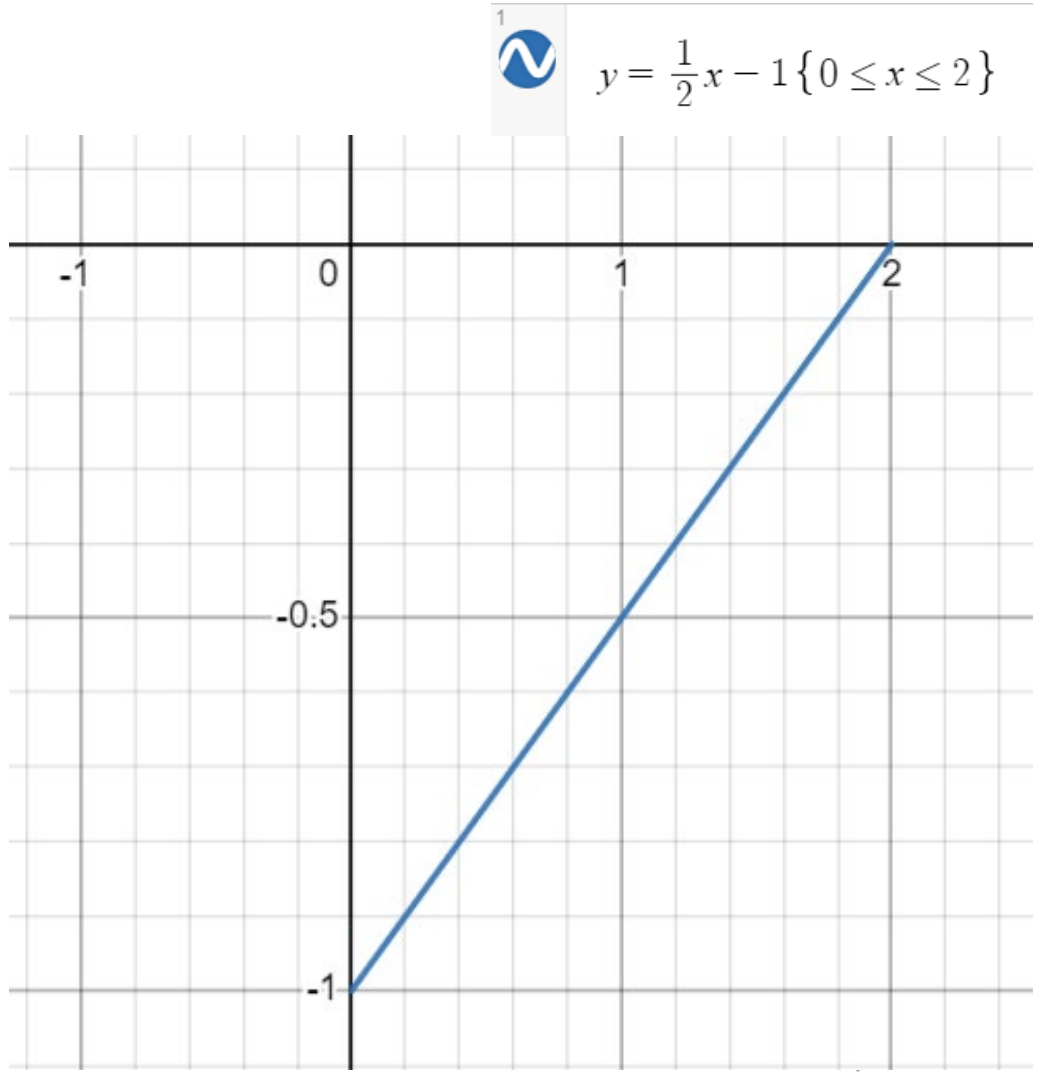
We can see that the middle point is halfway between the two x-values and half way between the two y-values.

This can be written in a more formal way:

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

But why are we adding the two x- and y-values and then dividing them by 2?

The easiest way to find the middle of two numbers is to add them together and divide by 2.



Examples of finding the mid-points of line segments

Find the midpoint $M(x, y)$ of the line segment joining the following pairs of points:

- $(1, 0)\ and\ (4, 4)$
- $(-3, -2)\ and\ (5, 3)$

$(1,0)$ $(4,4)$

$(2.5, 2)$

$(-3,-2)$ $(5,3)$

$(1, \frac{1}{2})$



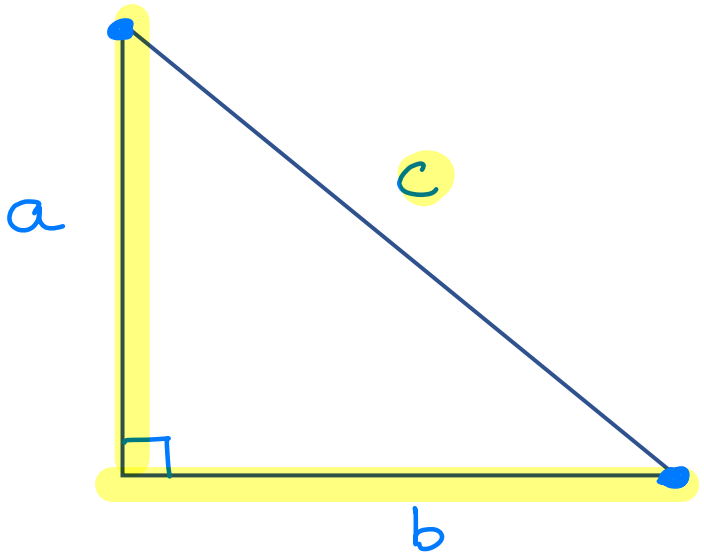
RECAP: Pythagoras's Theorem

We can find the length of line segments using Pythagoras' Theorem. I'm hoping you may have already covered this … if not … here is a "quick" recap.

We know for all right –angled triangles, we can find the lengths of the sides using the following formula:

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

$$c = \sqrt{a^2 + b^2}$$





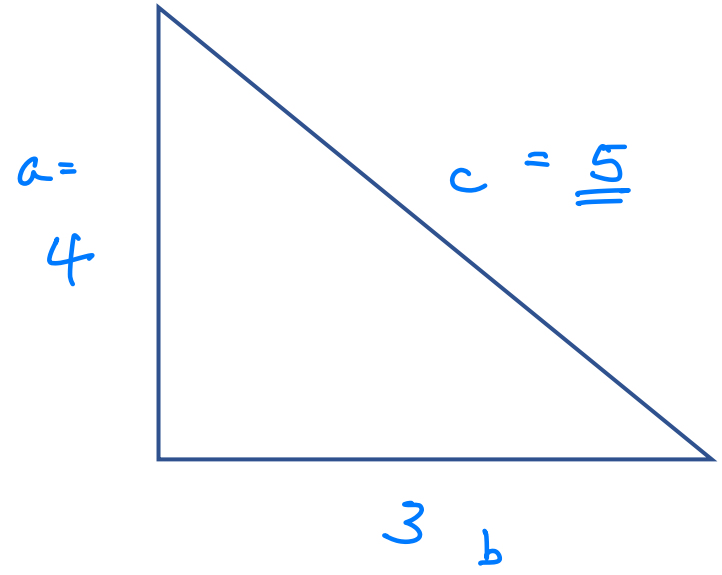
RECAP: Pythagoras's Theorem

Assuming we have two coordinates, we can find the diagonal length between them by going from:

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

To :

$$c = \sqrt{a^2 + b^2}$$



$$c = \sqrt{4^2 + 3^2}$$

$$= \sqrt{16 + 9}$$

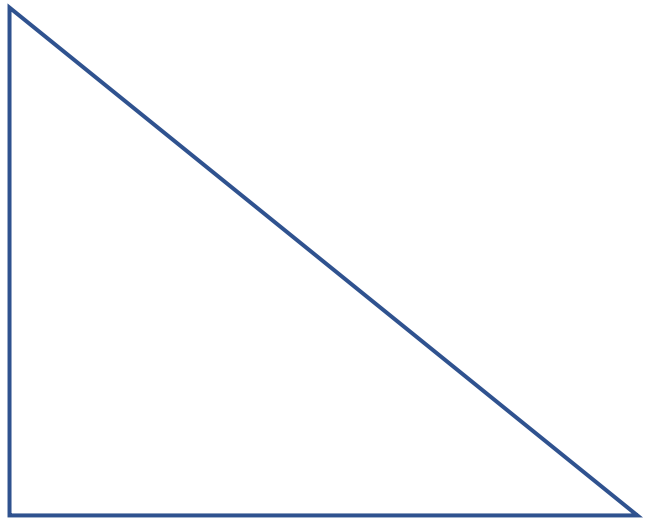
$$= \sqrt{25} = 5$$

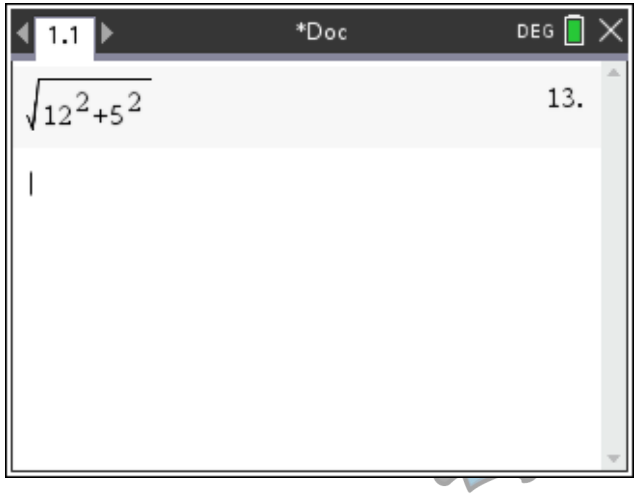


RECAP: Pythagoras's Theorem

So if we know the height of the triangle is 12 units and the base is 5 units then we can find the length of the longest side:

$$c = \sqrt{12^2 + 5^2}$$
$$c = 13$$





RECAP: Pythagoras's Theorem

We can find the length of line segments using Pythagoras' Theorem. I'm hoping you may have already covered this … if not … the main "formula" you are going to use is:

$$Length\ of\ line\ segment = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$c = \sqrt{a^2 + b^2}$$

This can be better thought of as:

- Find the difference in the x-coordinates and square the answer
- Find the difference in the y-coordinates and square the answer
- Add the two squares together
- Square root the answer.
- Write it down!



Example of finding the length of a line segment

Find the length of the segment joining $(-2, 2)$ and $(4, -1)$ **correct to two decimal places**.

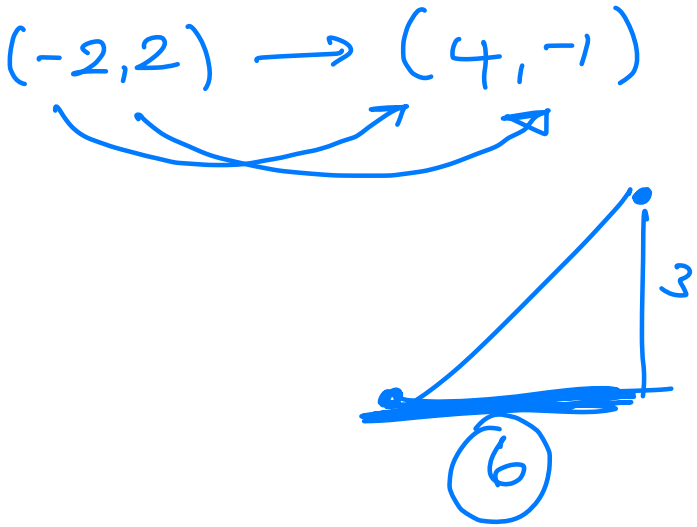
You are going to need to use your calculator to help you solve this.

Remember:

$$Length\ of\ line\ segment = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

$$= \sqrt{6^2 + 3^2}$$

$$= 6.71 \text{ units}$$



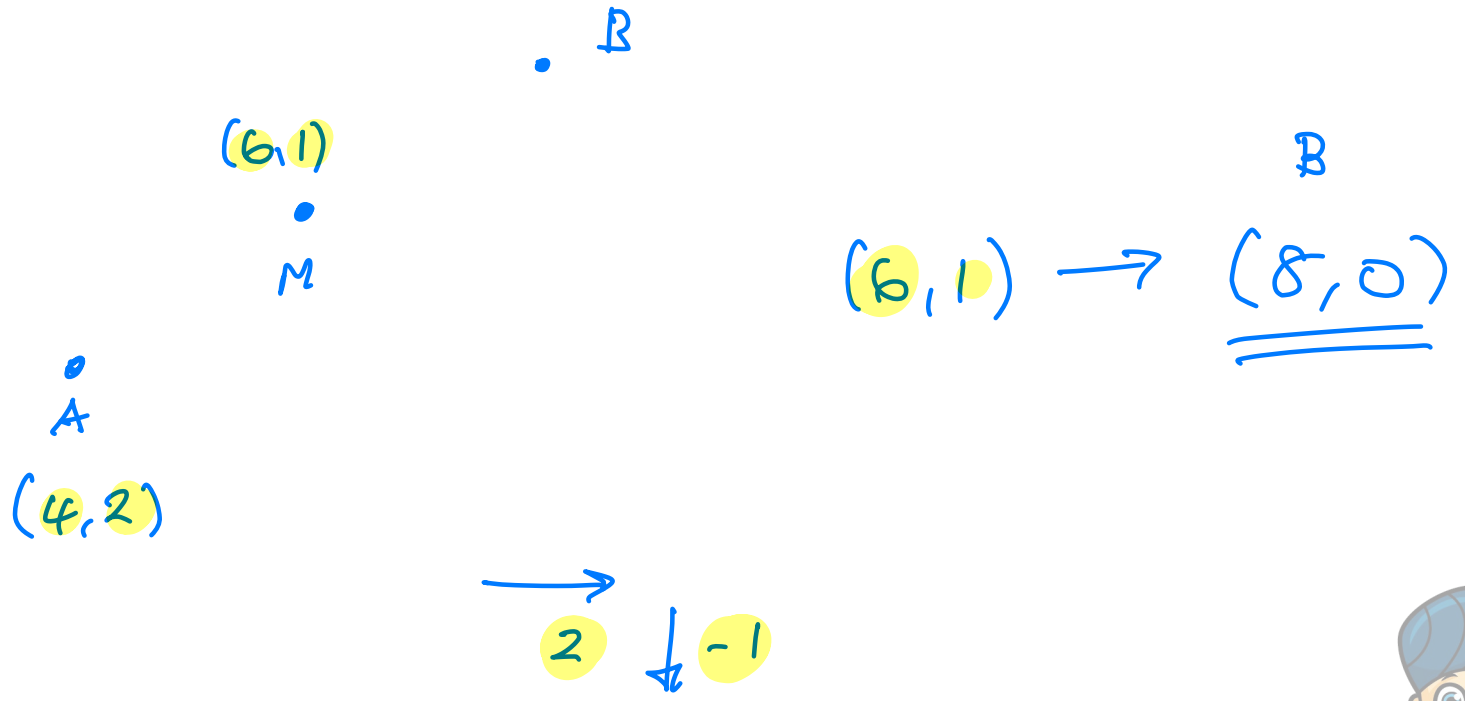


Finding a missing coordinate given one and the midpoint

Testing your understanding of this is really important.

So, what if I asked you to find the missing coordinate if I give you the following information:

$A(4,2)$ and $M(6,1)$





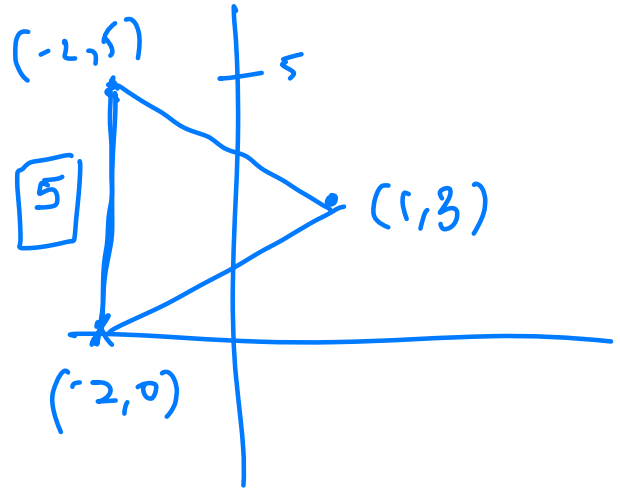
How do I use this?

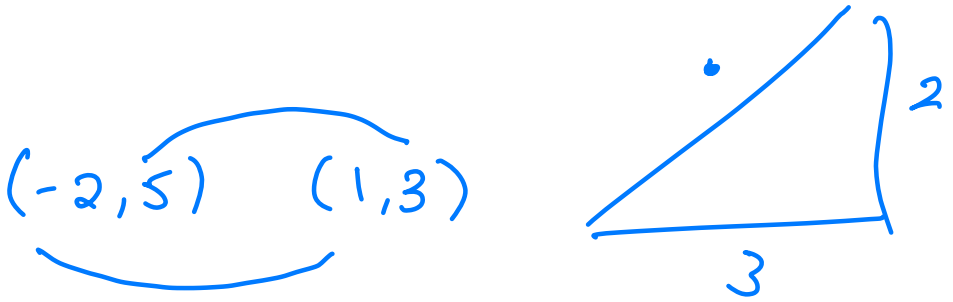
Exams can throw all sorts of questions at you which will test your understanding.

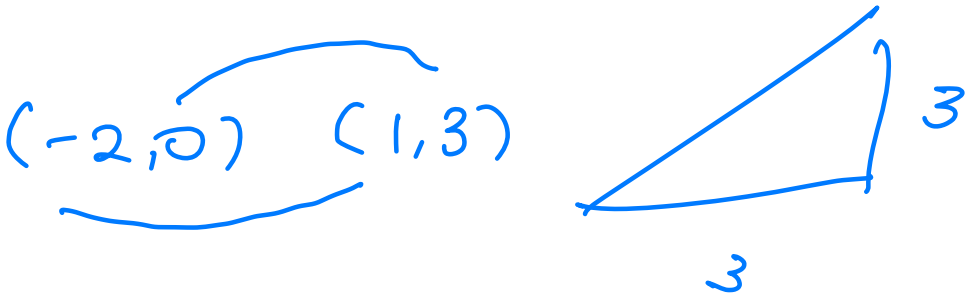
What would you do here:

Find the perimeter of these shapes correct to one decimal place:

- A triangle with vertices $(-2, 0), (-2, 5)\ and\ (1, 3)$











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