Maths Points

Junior and Leaving Cert

LCOL BASIC SKILLS
PACK 2

Leaving Cert Ordinary Level

LCOL Basic Skills: Pack 2 – Table of Contents

Topic, Year and Level

Maths Points

Junior and Leaving Cert

Express $\frac{3-2i}{1-4i}$ in the form $x + yi$.

Division in Complex Numbers
To divide by a complex number we multiply above and below by the conjugate of the denominator.

To find the **conjugate** of a complex number we change the sign of the imaginary component.

Complex Conjugate
$\overline{1-4i} = 1 + 4i$

$$\frac{3-2i}{1-4i}$$

$$= \frac{3-2i}{1-4i} \times \frac{1+4i}{1+4i}$$

$$= \frac{3(1+4i) - 2i(1+4i)}{1(1+4i) - 4i(1+4i)}$$

$$= \frac{3 + 12i - 2i - 8i^2}{1 + 4i - 4i - 16i^2}$$

$$= \frac{3 + 10i - 8(-1)}{1 - 16(-1)}$$

$i^2 = -1$

$$= \frac{3 + 10i + 8}{1 + 16}$$

$$= \frac{11 + 10i}{17}$$

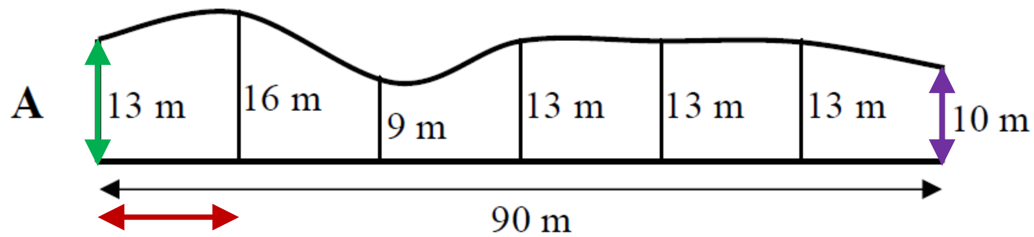
$$= \frac{11}{17} + \frac{10}{17}i$$

Use the Trapezoidal Rule to determine which of the shapes A or B below has the greater area, and by how much.

The formula for the **Trapezoidal Rule** is on **page 12** of the Maths Formulae Book.

Trapezoidal Rule

$$A = \frac{h}{2}\left(y_1 + y_n + 2(y_2 + y_3 + \cdots + y_{n-1})\right)$$



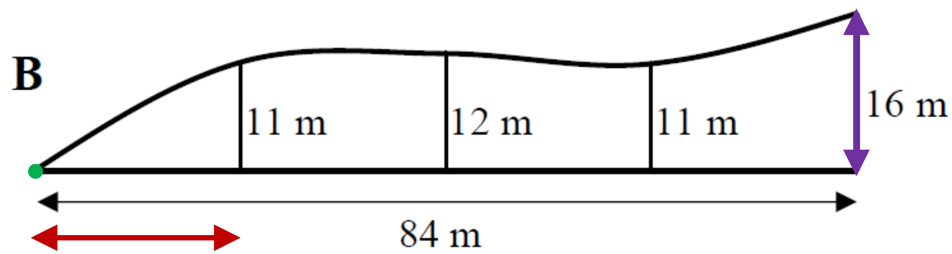
$$h = \frac{90}{6}$$

$$h = 15$$

$$A = \frac{h}{2}\left(\text{First} + \text{Last} + 2(\text{Sum of the Rest})\right)$$

$$A = \frac{15}{2}\left(13 + 10 + 2(16 + 9 + 13 + 13 + 13)\right)$$

$$A = 1132.5 \text{ m}^2$$



$$h = \frac{84}{4}$$

$$h = 21$$

$$A = \frac{h}{2}\left(\text{First} + \text{Last} + 2(\text{Sum of the Rest})\right)$$

$$A = \frac{21}{2}\left(0 + 16 + 2(11 + 12 + 11)\right)$$

$$A = 882 \text{ m}^2$$

Thus, shape A has the greater area.

It is greater by $1132.5 - 882 = 250.5 \text{ m}^2$

Let $f(x) = x^3 - 6x^2 + 9x - 3$.

Find $f'(x)$, the derivative of $f(x)$.

Differentiation – Power Rule

$f(x) = x^n$

$f'(x) = nx^{n-1}$

For each term bring the power to the front (multiply) and reduce the power by 1.

The derivative of any constant (a term independent of x) is 0.

$$f(x) = x^3 - 6x^2 + 9x - 3$$

$$f'(x) = 3x^2 - 12x + 9$$

Lagrange's Notation

The notation in this question is called prime notation (or **Lagrange's** notation). The 'prime' is a tick mark places after the function symbol, f.

$f'(x)$ reads 'f prime of x'.

Joseph-Louis Lagrange $(1736 - 1813)$ was an Italian mathematician.

Leibniz's Notation

$y = x^3 - 6x^2 + 9x - 3$

$\frac{dy}{dx} = 3x^2 - 12x + 9$

Leibniz and Isaac Newton worked independently of each other in the creation of 'calculus'.

A harbour is 6 km due East of a lighthouse.
A boat is 4 km from the lighthouse.
The bearing of the boat from the lighthouse is N 40° W.

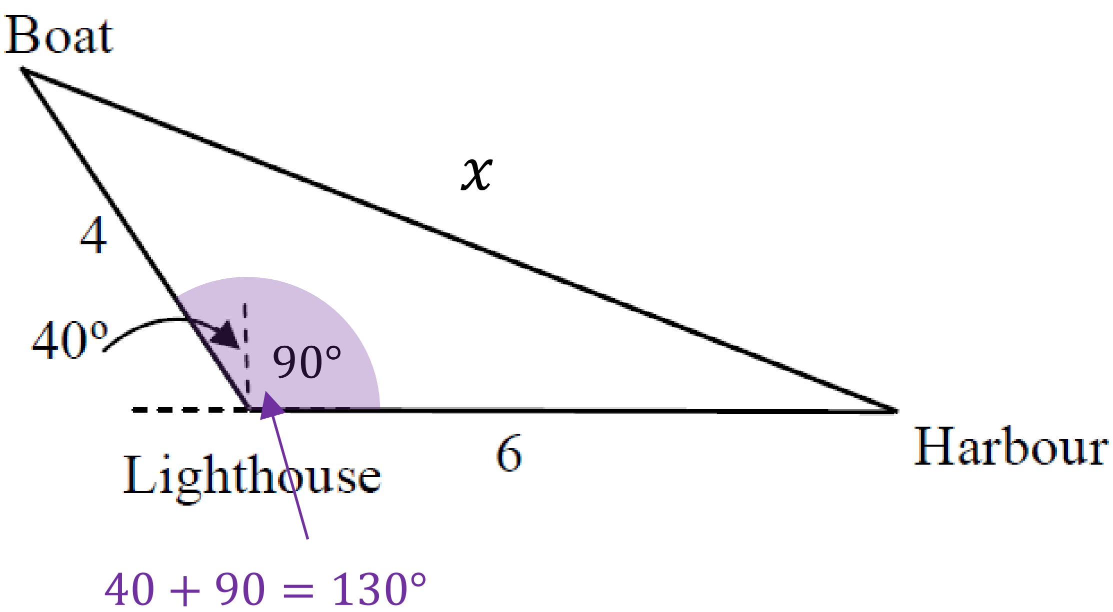
How far is the boat from the harbour?
Give your answer correct to one decimal place.

The **Cosine Rule** is on **page 16** of the Maths Formulae Book.

Let x be the distance from the Boat to the Harbour.

Cosine Rule

$a^2 = b^2 + c^2 - 2bc \cos A$



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$x^2 = 4^2 + 6^2 - 2(4)(6)\cos 130°$$

$$x^2 = 82.85$$

$$x = \sqrt{82.85}$$

$$x = 9.1 \text{ km}$$

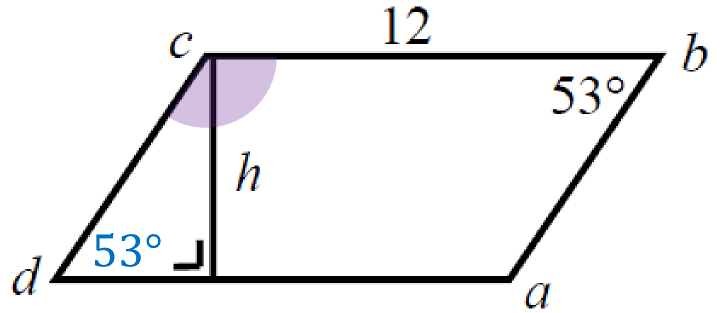
In the parallelogram $abcd$, $|\angle abc| = 53°$ and $|bc| = 12$ cm.

(i) Find $|\angle bcd|$.
(ii) Find the perpendicular height, h, given that the area of $abcd$ is 90 cm^2 .

(i)

Theorem 9

In a parallelogram, opposite sides are equal, and opposite angles are equal.



$$|\angle bcd| = \frac{1}{2}(360 - 2(53))$$

$$|\angle bcd| = \frac{1}{2}(360 - 106)$$

$$|\angle bcd| = \frac{1}{2}(254)$$

$$|\angle bcd| = 127°$$

(ii)

Area of a Parallelogram

$A =$ base × perpendicular height

The formula for the **Area of a Parallelogram** is on **page 8** of the Maths Formulae Book.

Let the formula for the area of a parallelogram equal 90 and solve for the height h.

$$12h = 90$$

$$h = \frac{90}{12}$$

$$h = 7.5 \text{ cm}$$

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