

FluidMaths

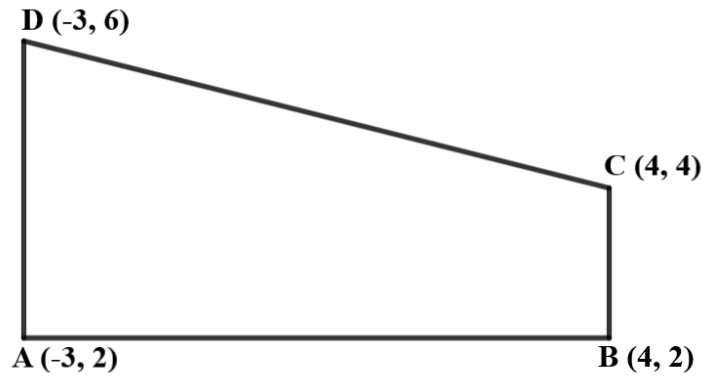
GCSE Mathematics (Grade 9-1)

Problem Solving – Trig 1 (SOHCAHTOA) – Solutions

The marks shown are for guidance purposes only

The questions are repeated here for your convenience

1 ABCD is a trapezium



A has coordinates $(-3, 2)$

B has coordinates $(4, 2)$

C has coordinates $(4, 4)$

D has coordinates $(-3, 6)$

Calculate angle ADC to the nearest degree

Solution

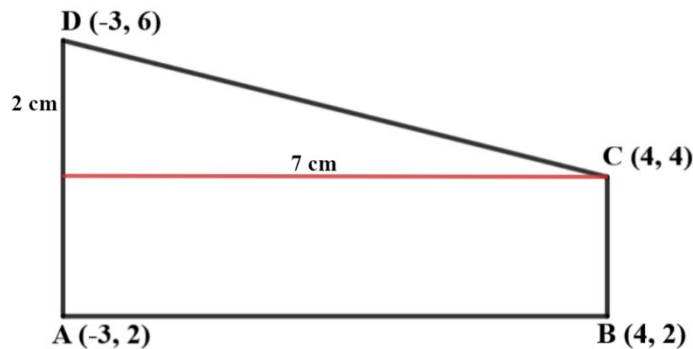
$$AB = 4 - -3 = 7$$

$$AD = 6 - 2 = 4$$

$$BC = 4 - 2 = 2$$

[2marks]

So, we have

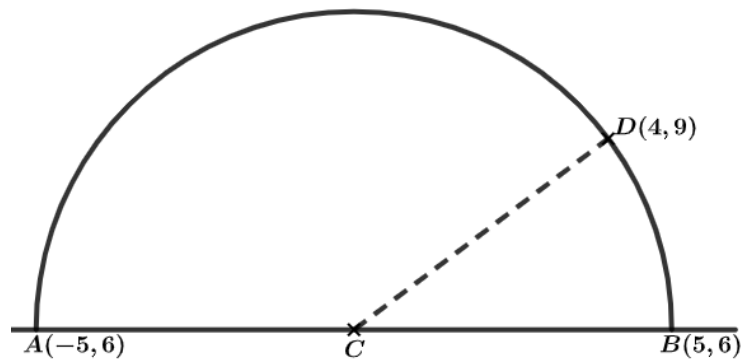


Now apply SOHCAHTOA

$$\tan ADC = \frac{7}{2} \quad [1\text{mark}]$$

$$\text{Angle ADC} = \tan^{-1} \left(\frac{7}{2} \right) = 74^\circ \text{ to the nearest degree } [1\text{mark}]$$

2 A semi-circle is shown below



AB is the diameter of the semi-circle and C is the centre

A has coordinates $(-5, 6)$

B has coordinates $(5, 6)$

D is on the circumference of the semi-circle and has coordinates $(4, 9)$

Calculate the length of the arc BD to 1 decimal place.

Solution

$$AB = 5 - -5 = 10 \quad [1\text{mark}]$$

The diameter of the semi-circle is 10

The coordinates of C = $(0, 6)$

Now we need to find angle DCB

{Refer to the diagram on RHS}

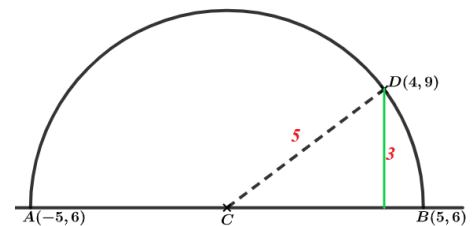
$$\sin DCB = \frac{3}{5} \quad [1\text{mark}]$$

$$DCB = \sin^{-1} \left(\frac{3}{5} \right)$$

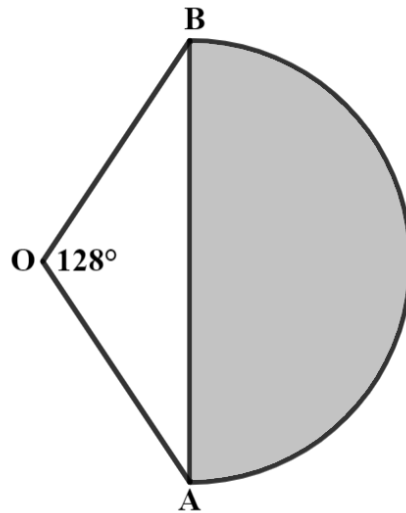
$$DCB = 36.9^\circ \quad [1\text{mark}]$$

$$\left\{ \text{Arc Length} = \frac{\theta}{360} \times \pi d \right\}$$

$$\text{Therefore, BD} = \frac{36.9}{360} \times 10 \times \pi = 3.2 \text{ (1dp)} \quad [1\text{mark}]$$



- 3 ABO is an isosceles triangle
A semi-circle is drawn to the side AB



$$AO = BO$$

$$\text{Angle AOB} = 128^\circ$$

The area of the semi-circle is 66 cm^2

Calculate the perimeter of the shape

Give your answer to 3 significant figures.

Solution

$$\text{Area of a semi-circle} = \frac{1}{2} \times \pi \times r^2$$

$$\text{Therefore, } \frac{1}{2} \times \pi \times r^2 = 66$$

$$r^2 = \frac{2 \times 66}{\pi}$$

$$r = \sqrt{\frac{132}{\pi}} = 6.48 \text{ (3sf) [1mark]}$$

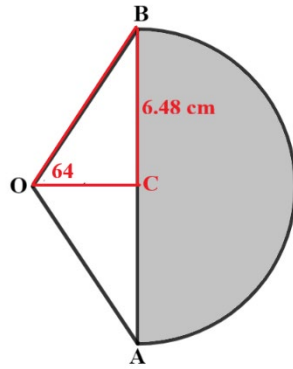
Therefore, the diameter AB is 12.96 cm

The circumference of a semi-circle = $\pi d \div 2$

Therefore, the circumference of the semi-circle will be

$$12.96\pi \div 2 = 20.4(3\text{sf}) \text{ [1mark]}$$

Apply SOHCAHTOA to triangle OBC



Notice that BC is the radius of the semi-circle

Triangle AOB is an isosceles triangle

Therefore, angle BOC = $128 \div 2 = 64$ [1mark]

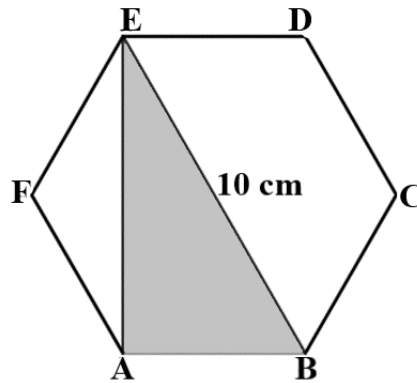
Therefore, $\sin 64 = \frac{6.48}{OB}$

So $OB = \frac{6.48}{\sin 64} = 7.21$ (3sf) [1mark]

The perimeter of the shape will be

$2 \times 7.21 + 20.4 = 34.8\text{cm}$ (3sf) [1mark]

- 4 ABCDEF is a regular hexagon
 ABE is a right-angled triangle



$$BE = 10 \text{ cm}$$

Calculate the perimeter of the hexagon

Solution

Calculate one of the angles inside triangle ABE

An interior angle in a regular hexagon is $720 \div 6 = 120$

Angle EDC = Angle BCD = 120 [1mark]

Angle CBE = Angle DEB = $360 - 240 = 120 \div 2 = 60$

Therefore, angle ABE = $120 - 60 = 60^\circ$ [1mark]

Apply SOHCAHTOA to triangle ABE

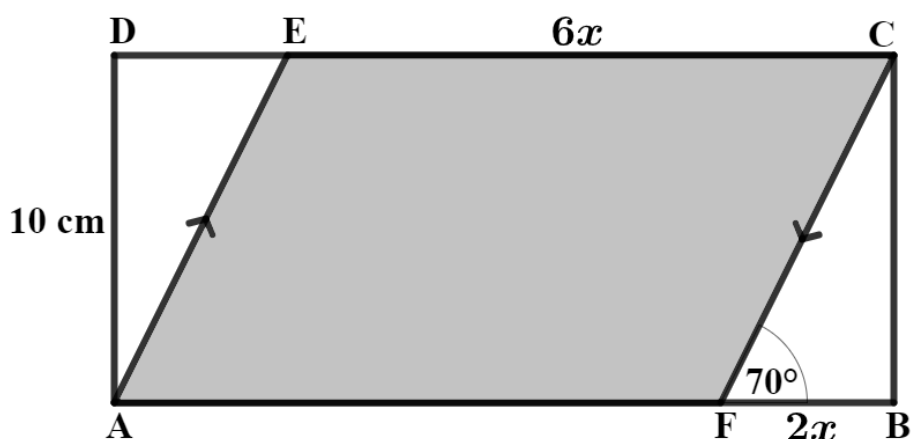
$$\cos 60 = \frac{AB}{10}$$

$$AB = 10 \times \cos 60$$

$$AB = 5 \text{ cm} \quad [1\text{mark}]$$

Hence, the perimeter of the hexagon will be $6 \times 5 = 30 \text{ cm}$
 [1mark]

5 ABCD is a rectangle



$$AD = 10 \text{ cm}$$

$$EC = 6x$$

$$FB = 2x$$

$$\text{Angle CFB} = 70^\circ$$

Calculate the area of the parallelogram AFCE

Give your answer to 3 significant figures.

Solution

The perpendicular height of the parallelogram is 10 cm.

Find the length of the side AF

Notice that $AF = EC = 6x$

Consider triangle FBC on the RHS

Apply SOHCAHTOA

$$\tan 70 = \frac{10}{2x}$$

$$2x = \frac{10}{\tan 70} = 3.64 \text{ (3sf) [2marks]}$$

$$\text{Therefore, } 2x = 3.64$$

$$x = 1.82 \text{ [1mark]}$$

$$\text{Therefore, } AF = 6 \times 1.82 = 10.9 \text{ [1mark]}$$

Hence the area of the parallelogram is

$$10.9 \times 10 = 109 \text{ cm}^2 \text{ (3sf) [1mark]}$$

