10. A sector AOB, of a circle centre O, has radius r cm and angle θ radians.

Given that the area of the sector is 6 cm² and that the perimeter of the sector is 10 cm,

(a) show that

$$3\theta^2 - 13\theta + 12 = 0$$

(4)

(b) Hence find possible values of r and θ.

(3)

6.

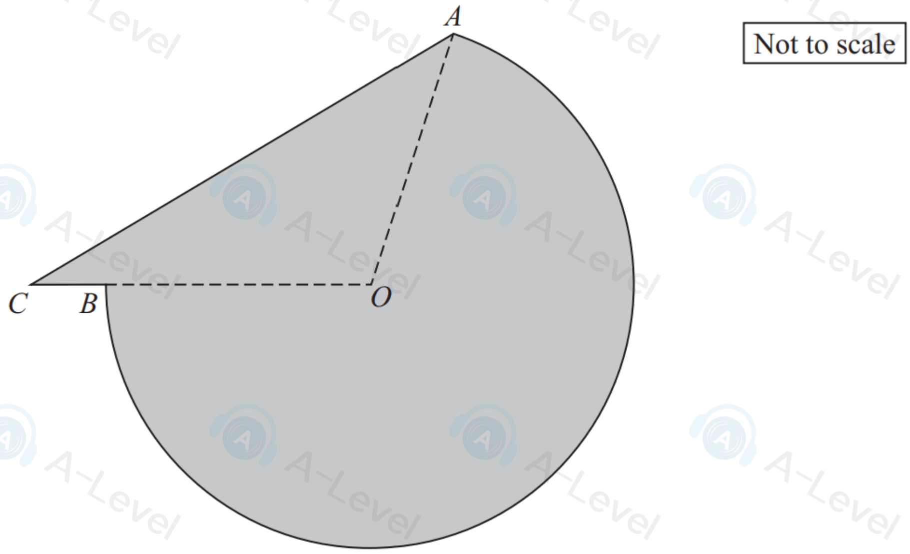

Figure 2

The shaded area in Figure 2 shows the plan view of a helicopter landing pad.

The area consists of the major sector AOB of a circle centre O joined to a triangle AOC.

Given that

- $AO = OB = 15$ m
- $BC = 2$ m
- CBO is a straight line
- angle $ACO = 0.6$ radians

(a) show that angle COA is 1.847 radians to 3 decimal places.

(3)

(b) Find the total area of the helicopter landing pad.
Give your answer in m² to 3 significant figures.

(3)

(c) Find the perimeter of the helicopter landing pad.
Give your answer in metres to 3 significant figures.

(3)

Leave blank

11. A curve has equation $y = \mathrm{f}(x)$, where

$$\mathrm{f}''(x) = \frac{6}{\sqrt{x^3}} + x \qquad x > 0$$

The point $P(4, -50)$ lies on the curve.

Given that $\mathrm{f}'(x) = -4$ at P,

(a) find the equation of the normal at P, writing your answer in the form $y = mx + c$, where m and c are constants,

(3)

(b) find $\mathrm{f}(x)$.

(8)

DO NOT WRITE IN THIS AREA

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9. **In this question you must show all stages of your working.**

Solutions relying on calculator technology are not acceptable.

A curve has equation

$$y = \frac{4x^2 + 9}{2\sqrt{x}} \qquad x > 0$$

Find the x coordinate of the point on the curve at which $\frac{\mathrm{d}y}{\mathrm{d}x} = 0$

(6)

DO NOT WRITE IN THIS

5. **In this question you must show all stages of your working.**

Solutions relying on calculator technology are not acceptable.

(a) By substituting $p = 3^x$, show that the equation

$$3 \times 9^x + 3^{x+2} = 1 + 3^{x-1}$$

can be rewritten in the form

$$9p^2 + 26p - 3 = 0$$

(3)

(b) Hence solve

$$3 \times 9^x + 3^{x+2} = 1 + 3^{x-1}$$

(3)

DO NOT WRITE IN THIS AREA

2. $$\mathrm{f}(x) = 11 - 4x - 2x^2$$

(a) Express f(x) in the form

$$a + b(x + c)^2$$

where a, b and c are integers to be found.

(3)

(b) Sketch the graph of the curve C with equation $y = \mathrm{f}(x)$, showing clearly the coordinates of the point where the curve crosses the y-axis.

(2)

(c) Write down the equation of the line of symmetry of C.

(1)

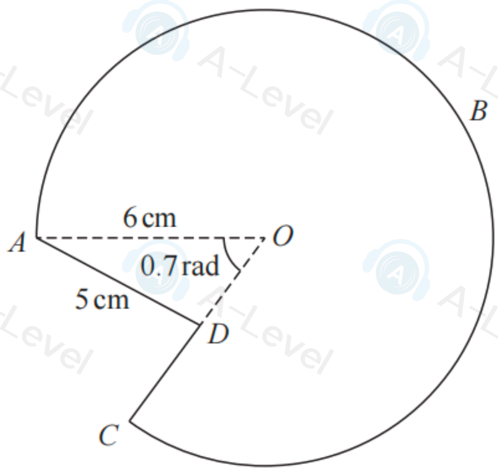
1. Given that

$$(3pq^2)^4 \times 2p\sqrt{q^8} \equiv ap^bq^c$$

find the values of the constants a, b and c.

(3)

7.



Not to scale

Figure 2

The shape $ABCDA$ consists of a sector $ABCOA$ of a circle, centre O, joined to a triangle AOD, as shown in Figure 2.

The point D lies on OC.

The radius of the circle is 6 cm, length AD is 5 cm and angle AOD is 0.7 radians.

(a) Find the area of the sector $ABCOA$, giving your answer to one decimal place.

(3)

Given angle ADO is obtuse,

(b) find the size of angle ADO, giving your answer to 3 decimal places.

(3)

(c) Hence find the perimeter of shape $ABCDA$, giving your answer to one decimal place.

(4)

2. **In this question you must show all stages of your working.**

Solutions relying on calculator technology are not acceptable.

(a) Solve

$$5(x + 3) > 4(2x - 5)$$

(2)

(b) (i) Write

$$x^2 - 6x + 1$$

in the form $(x + a)^2 + b$ where a and b are constants.

(ii) Hence solve

$$x^2 - 6x + 1 \geqslant 0$$

(4)

(c) Hence find the values of x that satisfy both

$$5(x + 3) > 4(2x - 5) \quad \textbf{and} \quad x^2 - 6x + 1 \geqslant 0$$

(1)

DO NOT WRITE IN THIS AREA

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3. The line l_1 has equation $3x + 5y - 7 = 0$

(a) Find the gradient of l_1

(2)

The line l_2 is perpendicular to l_1 and passes through the point $(6, -2)$.

(b) Find the equation of l_2 in the form $y = mx + c$, where m and c are constants.

(3)

DO NOT WRITE IN THI

6. **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

The curve C has equation $y = f(x)$, $x > 0$

Given that

- the point $P(4, -5)$ lies on C
- $f'(x) = \dfrac{2x^2 + ax + b}{4\sqrt{x}}$, where a and b are constants
- the gradient of the tangent to C at P is 7

(a) show that

$$4a + b = 24$$

(2)

Given also that $a + b = -9$

(b) find, in simplest form, $f(x)$

(7)

Curve C is transformed to the curve with equation $y = f(x - 3)$

Given that point P is transformed to the point Q,

(c) state the coordinates of Q.

(1)

blank

1. Find

$$\int 12x^3 + \frac{1}{6\sqrt{x}} - \frac{3}{2x^4}\,dx$$

giving each term in simplest form.

(5)

4. The curve C_1 has equation

$$y = x^2 + kx - 9$$

and the curve C_2 has equation

$$y = -3x^2 - 5x + k$$

where k is a constant.

Given that C_1 and C_2 meet at a single point P

(a) show that

$$k^2 + 26k + 169 = 0$$

(3)

(b) Hence find the coordinates of P

(3)