Fortify Your Maths

Any solution based entirely on graphical
or numerical methods is not acceptable

Marks Available : 30

Question 1

Find the values of k for which $k\,x^2 + 8x + 5 = 0$ has distinct real roots, $k \in \mathbb{R}$
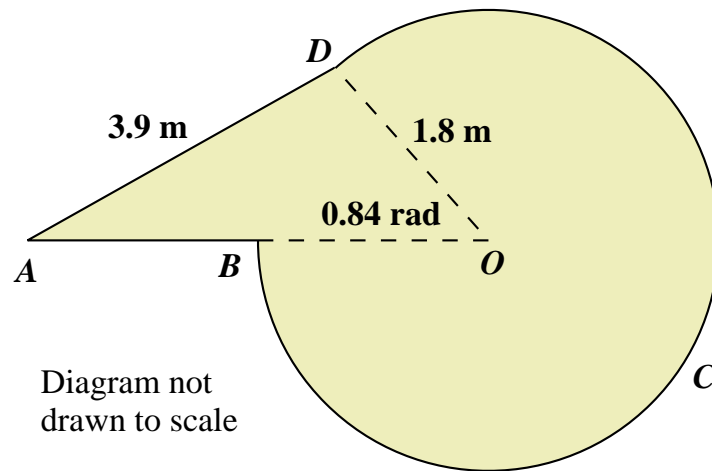
[**3 marks**]

Question 2

$$f(x) = p\,x^3 - 3p\,x^2 + x^2 - 4, \text{ where } p \text{ is a constant}$$

Given that, when $x = 2, \ f''(x) = -1$, find the value of p

[**3 marks**]

Question 3

A-Level Examination Question from January 2019, Paper C12, Q10b (Edexcel)

Diagram not drawn to scale

The diagram shows the design for a shop sign *ABCDA*.

The sign consists of a triangle *AOD* joined to a sector of a circle *DOBCD* with radius 1.8 m and centre *O*. The points *A, B* and *O* lie on a straight line.
It is given that *AD* = 3.9 m and angle *BOD* is 0.84 radians.

(a)   Calculate the size of angle *DAO*, giving your answer in radians to 3 decimal places

[2 marks]

(b)   Show that, to one decimal place, the length of *AO* is 4.9 metres.

[3 marks]

(c)   Find, in m², the area of the shop sign, giving your answer to one decimal place.

[3 marks]

(d)   Find, in metres, the perimeter of the shop sign, giving your answer to one decimal place

[3 marks]

Question 4

(**i**)   Given that $y = \dfrac{1}{4x + 1}$ find the value of $\dfrac{dy}{dx}$ when $x = \dfrac{1}{4}$

[**3 marks**]

(**ii**)   Hence find the equation of the tangent to the curve when $x = \dfrac{1}{4}$
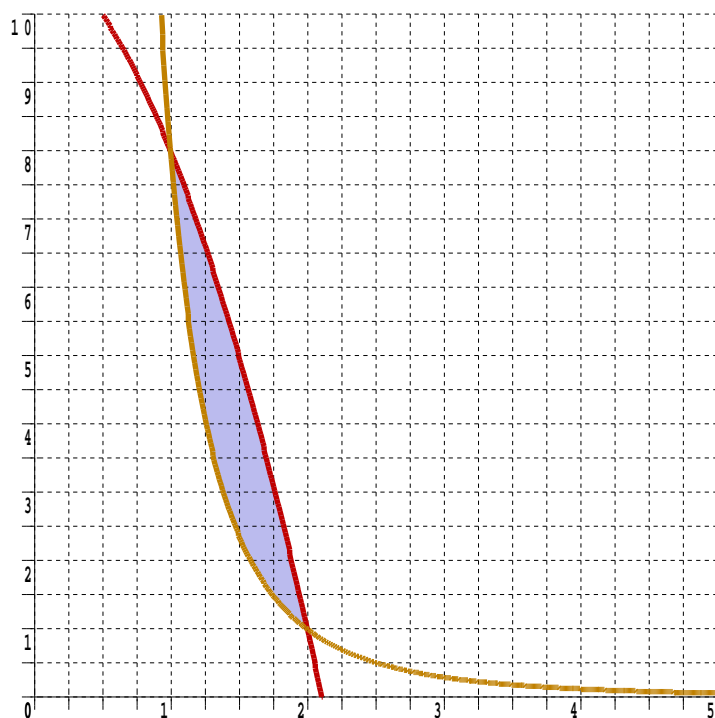
[**2 marks**]

Question 5

Given that $x = 3 \sin y$ $\qquad -\dfrac{\pi}{2} < y < \dfrac{\pi}{2}$

show that $\dfrac{dy}{dx} = \dfrac{1}{\sqrt{9 - x^2}}$

[**4 marks**]

Question 6

A-Level Examination Question from June 2017, Paper C2, Q6 (OCR)

The diagram shows parts of the curves $y = 11 - x - 2x^2$ and $y = \dfrac{8}{x^3}$

The curves intersect at (1, 8) and (2, 1)

Use integration to find the exact area of the shaded region enclosed between the two curves.

[4 marks]