**1**  **a**  Find an equation of the tangent to the curve $y = 2 + 3x - 2x^2$ at the point $A$ (2, 0). **(4 marks)**

    **b**  Find an equation of the tangent to the curve $y = 2 + 3x - 2x^2$ at the point $B$, where it meets the $y$-axis. **(3 marks)**

    **c**  Find the coordinates of the point $C$, where the tangents you have found in parts **a** and **b** intersect. **(3 marks)**

**2**
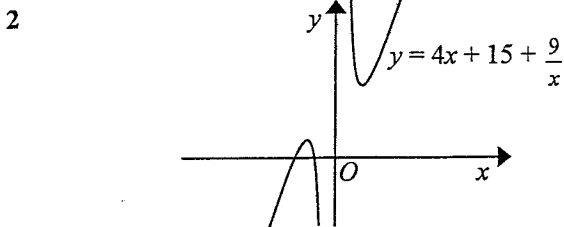


$y = 4x + 15 + \dfrac{9}{x}$

The diagram shows part of the curve $y = 4x + 15 + \dfrac{9}{x}$

    **a**  Find the coordinates of the points where the curve intersects the $x$-axis. **(4 marks)**

    **b**  Find the coordinates of the turning points of the curve. **(5 marks)**

**3**
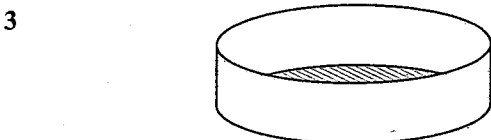


The diagram shows an open-topped cylindrical cake tin.

Given that the volume of the tin is to be $1000\pi$ cm$^3$,

    **a**  find an expression for the height, $h$ cm, of the tin in terms of the radius of the base of the tin, $r$ cm. **(2 marks)**

    **b**  show that the area of metal, $A$ cm$^2$, used in making the tin is given by $A = \pi r^2 + \dfrac{2000\pi}{r}$. **(3 marks)**

Given that $r$ can vary,

    **c**  find the minimum value of $A$ in terms of $\pi$, **(6 marks)**

    **d**  justify that your value is a minimum. **(3 marks)**

**4**              $f(x) \equiv x^3 - x^2 + kx + 2.$

Given that $(x - 2)$ is a factor of $f(x)$,

    **a**  find the value of the constant $k$, **(2 marks)**

    **b**  find exactly the set of values of $x$ for which $f(x)$ is decreasing. **(6 marks)**

**5**
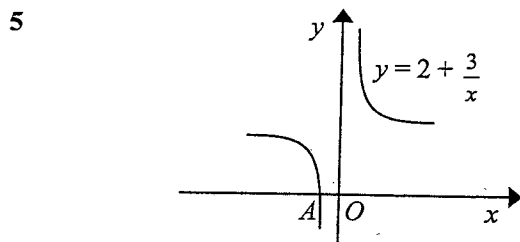


$y = 2 + \dfrac{3}{x}$

The diagram shows part of the curve $y = 2 + \dfrac{3}{x}$.

The curve intersects the $x$-axis at the point $A$.

    **a**  Find the coordinates of the point $A$. **(2 marks)**

    **b**  Find an equation of the normal to the curve at the point $A$. **(6 marks)**

    **c**  Show that the normal intersects the curve again at the point with coordinates $\left(\frac{8}{3}, \frac{25}{8}\right)$. **(5 marks)**

**6** The number of people in thousands, $P$, at an outdoor festival $h$ hours after the gates open is modelled with the formula

$$P = 15h + 6h^2 - h^3, \text{ for } h \geq 0.$$

Using this model,

a find an expression in terms of $h$ for the rate at which $P$ increases, **(2 marks)**

b show that the population is increasing most rapidly when $h = 2$, **(3 marks)**

c find the number of people entering the festival per minute when $h = 2$, assuming that no one is leaving. **(3 marks)**

**7**
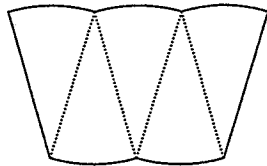


The diagram shows the shape of a new biscuit, consisting of five circular sectors, each of radius $r$ cm and angle $\theta$ radians.

a Find expressions in terms of $r$ and $\theta$ for the perimeter and area of the shape. **(4 marks)**

Given that the area of the shape is to be 40 cm$^2$,

b show that the perimeter of the shape, $P$ cm, can be expressed as

$$P = 20\theta^{\frac{1}{2}} + 8\theta^{-\frac{1}{2}}.$$ **(4 marks)**

Given that $\theta$ can vary,

c find the value of $\theta$ for which $P$ is a minimum and find the corresponding value of $P$ in the form $k\sqrt{10}$. **(7 marks)**

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### Exercise 16E    Exam Practice

1  a $y = -5x + 10$  b $y = 3x + 2$  c $(1, 5)$

2  a $(-3, 0)$, $(-^3/_4, 0)$  b $(-^3/_2, 3)$, $(^3/_2, 27)$

3  a $h = \frac{1000}{r^2}$    c $300\pi$

4  a $-3$  b $^1/_3(1 - \sqrt{10}) < x < ^1/_3(1 + \sqrt{10})$

5  a $(-^3/_2, 0)$    b $6x - 8y + 9 = 0$

6  a $(15 + 12h - 3h^2)$ /hr    c $450$ /min

7  a $^5/_2 r^2 \theta$ cm$^2$    c $^2/_5$, $8\sqrt{10}$