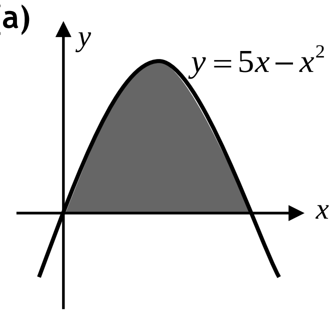
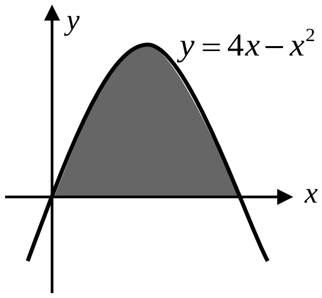
NR3 I can evaluate the area enclosed between a function and the x axis.

1. Find the shaded area in the following diagrams

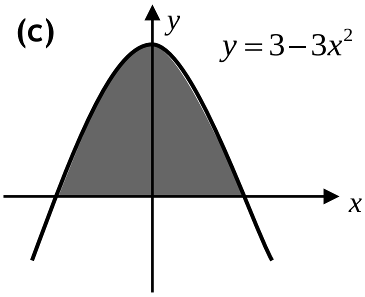
(a)



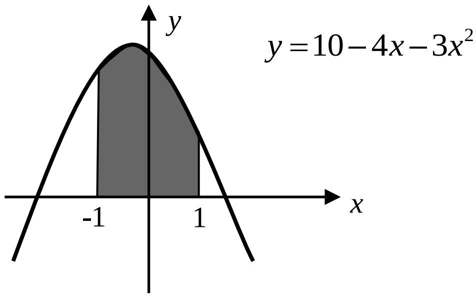
(b)



(c)



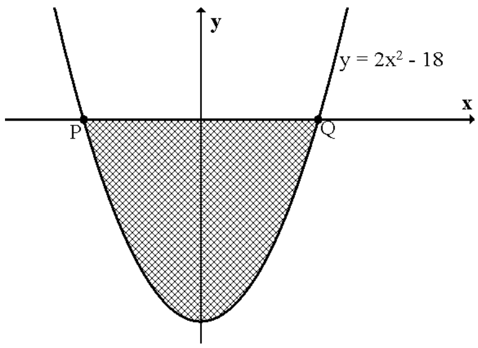
(d)



2. The diagram shows part of the graph of $y = 2x^2 - 18$.

(a) Find the coordinates of P and Q.

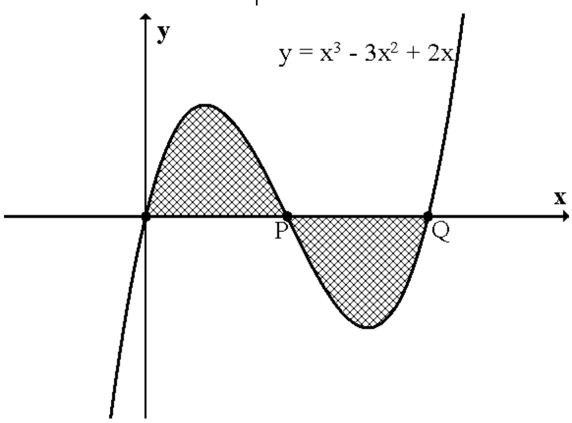
(b) Find the shaded area.



3. The diagram shows part of the graph of $y = x^3 - 3x^2 + 2x$.

(a) Find the coordinates of P and Q.

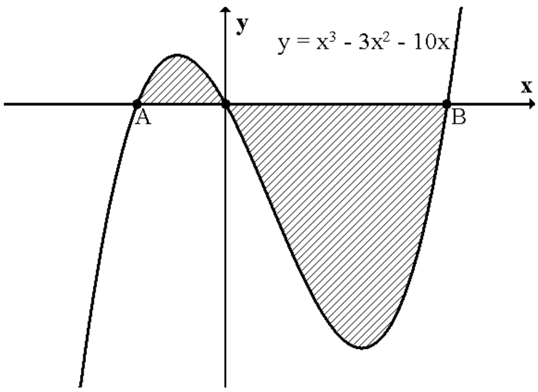
(b) Calculate the shaded area.



4. The diagram shows the graph of $y = x^3 - 3x^2 - 10x$.

(a) Find the coordinates of A and B.

(b) Calculate the shaded area.

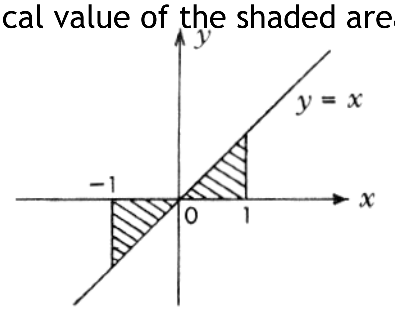


5. Which of the following gives the numerical value of the shaded area?

(I) $\int_{-1}^{1} x\,dx$

(II) $\int_{-1}^{0} x\,dx + \int_{0}^{1} x\,dx$

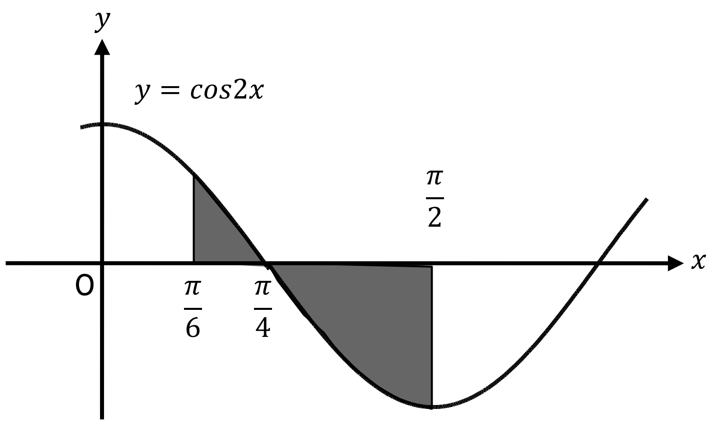
(III) $2\int_{0}^{1} x\,dx$



A (I) only B (II) only C (III) only D (I), (II) and (III)

6. An artist has designed a "bow" shape which he finds can be modelled by the shaded area shown.

Calculate the area of this shape.

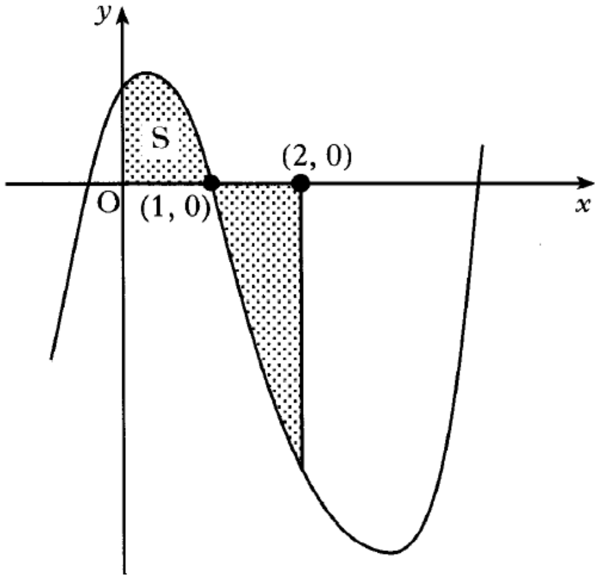


7. The graph below has equation $y = x^3 - 6x^2 + 4x + 1$.

The total shaded aread is bounded by the curve, the x-axis, the y-axis and the line $x = 2$.

(a) Calculate the shaded area labelled S.

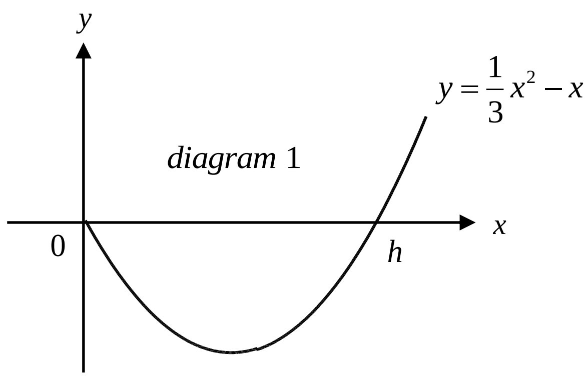
(b) Hence find the total shaded area.



8. Diagram 1 shows the profit/loss function for the manufacture of x thousand kitchen units.

The profit/loss is measured in millions of £s and is represented by the area between the function and the x-axis .

Any area below the x-axis represents a loss; any area above the x-axis represents a profit.

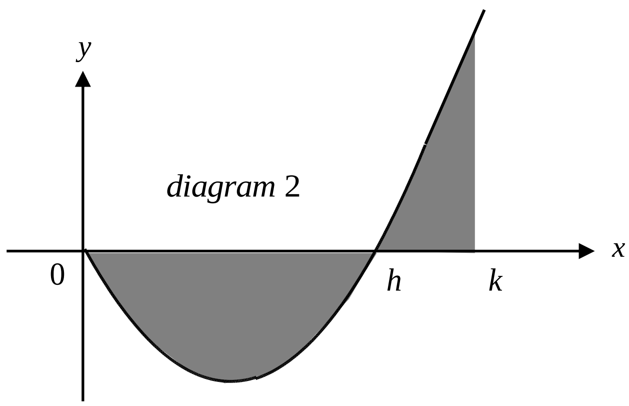


The profit/loss function is given by $f(x)=\frac{1}{3}x^2-x$ where $x\geq 0$.

(a) Find the value of ***h***.

(b) Diagram 2 (not drawn to scale) represents the breakeven situation where the initial loss made on selling the first ***h*** thousand units is exactly balanced by the later profit.

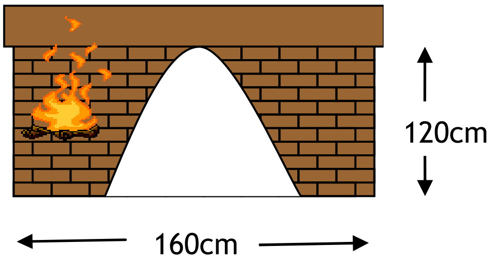
Calculate the value of ***k***.

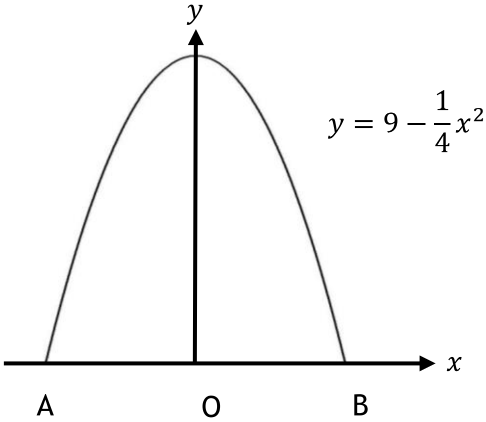


9. The fire surround is rectangular, with a parabolic opening for the fire.

(a) Find the coordinates of A and B.

(b) Calculate the tiled area (1 unit = 10cm).

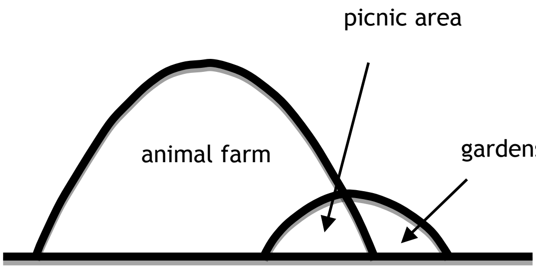


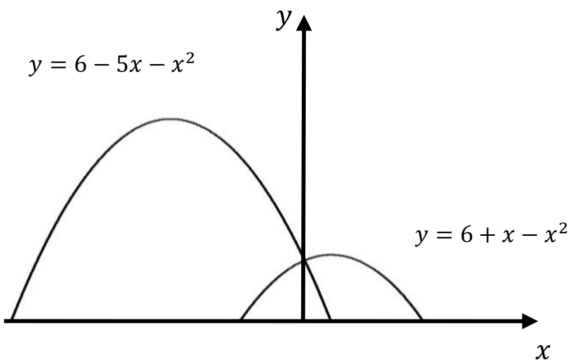


10. Millennium Park is based on two parabola shapes.

A plan is laid out in the coordinate diagram.

Calculate the areas of the three parts of the park on the diagram.

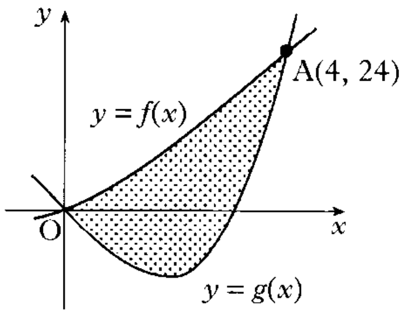




NR4 I can evaluate the area enclosed between two functions.

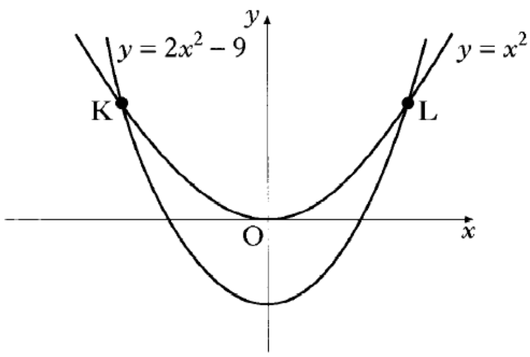
1. The incomplete graphs of $f(x) = x^2 + 2x$ and $g(x) = x^3 - x^2 - 6x$ are shown in the diagram. The graphs intersect at A(4, 24) and the origin.

Find the shaded area enclosed between the curves.

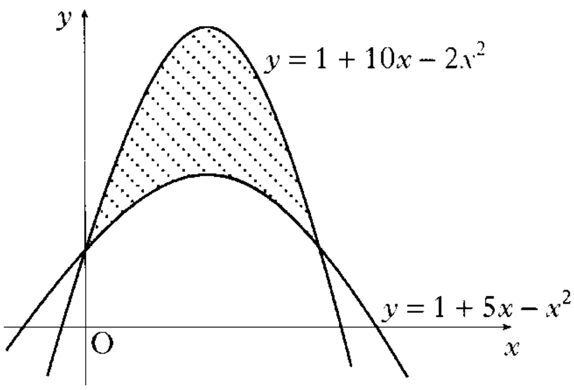


2. The curves with equations $y = x^2$ and $y = 2x^2 - 9$ intersect at K and L as shown.

Calculate the area enclosed between the curves.

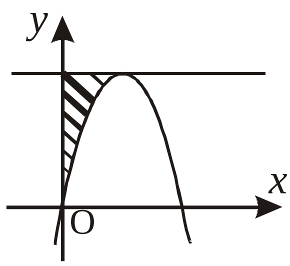


3. Calculate the shaded area enclosed between the parabolas with equations $y = 1 + 10x - 2x^2$ and $y = 1 + 5x - x^2$.



4. Calculate the area enclosed by the line $y = 3(x - 1)$ and the parabola $y = 3 + 2x - x^2$

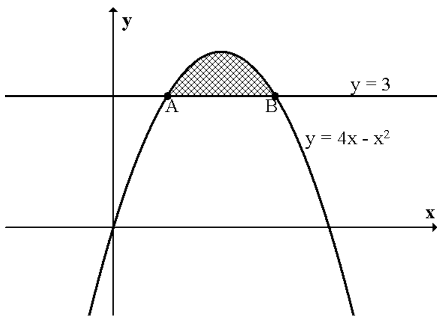
5. This diagram shows a rough sketch of the quadratic function $y = 6x - x^2$. The tangent at the maximum stationary point has been drawn.



(a) Explain clearly why the tangent has equation y = 9.

(b) Calculate the shaded area enclosed by the curve, the tangent and the y-axis.

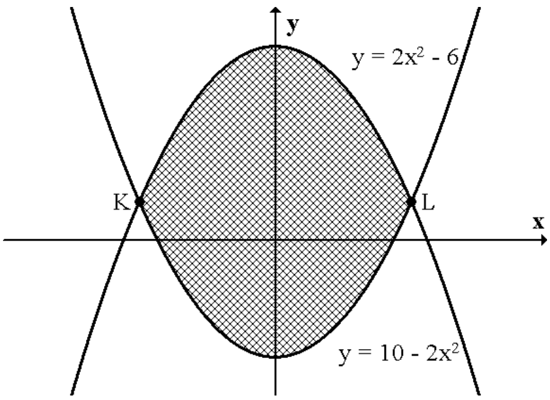
6. The diagram opposite shows the curve $y = 4x - x^2$ and the line $y = 3$.



(a) Find the coordinates of A and B.

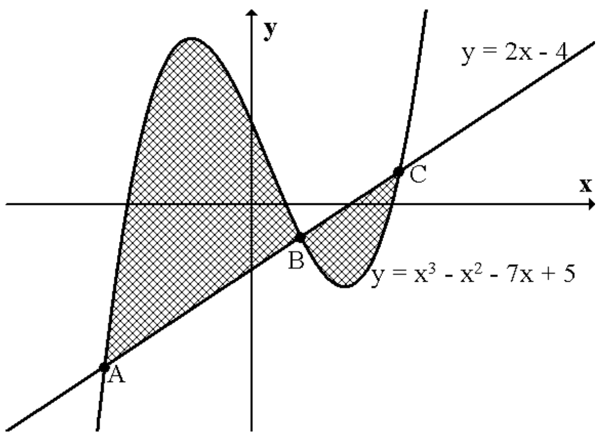
(b) Calculate the shaded area.

7. The curves with equations $y = 2x^2 - 6$ and $y = 10 - 2x^2$ intersect at K and L. Calculate the area enclosed by these two curves.



8. The curve $y = x^3 - x^2 - 7x + 5$ and the line $y = 2x - 4$ are shown opposite.

(a) B has coordinates (1,-2). Find the coordinates of A and C.
(b) Hence calculate the shaded area.

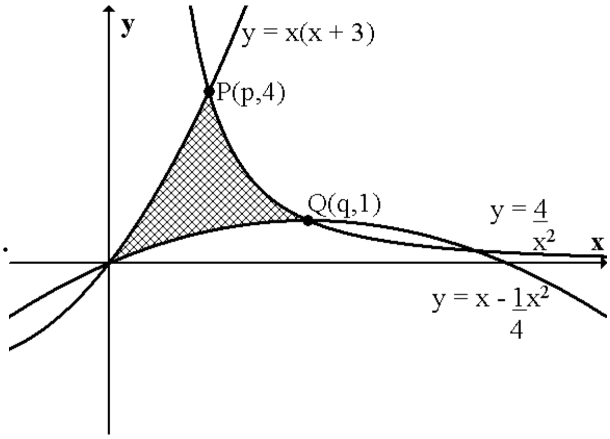


9. The diagram opposite shows an area enclosed by 3 curves:

$y = x(x+3)$, $y = \frac{4}{x^2}$ and $y = x - \frac{1}{4}x^2$

(a) P and Q have coordinates (p,4) and (q,1). Find the values of p and q.

(b) Calculate the shaded area.



10. This diagram shows 2 curves $y = f_1(x)$ and $y = f_2(x)$ which intersect at $x = a$.

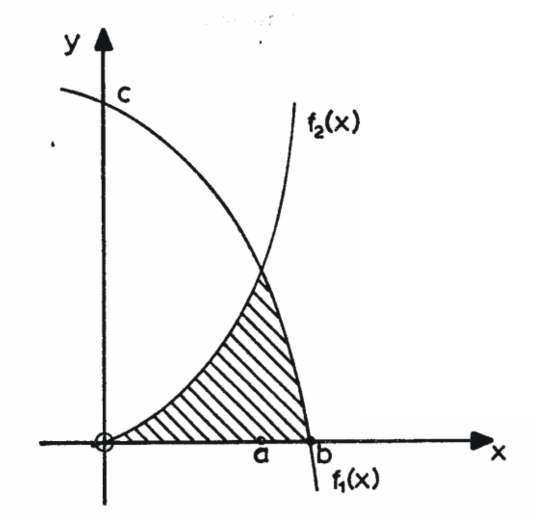
The area of the shaded region is

A $\int_0^b f_1(x)dx - \int_0^a f_2(x)dx$

B $\int_0^a f_2(x)dx + \int_a^b f_1(x)dx$

C $\int_0^a f_2(x)dx - \int_a^b f_1(x)dx$

D $\int_0^a f_1(x)dx + \int_a^b f_2(x)dx$

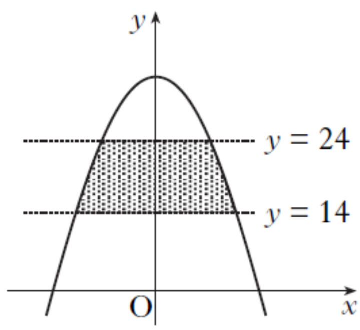


11. The parabola shown in the diagram has equation

$$y = 32 - 2x^2.$$

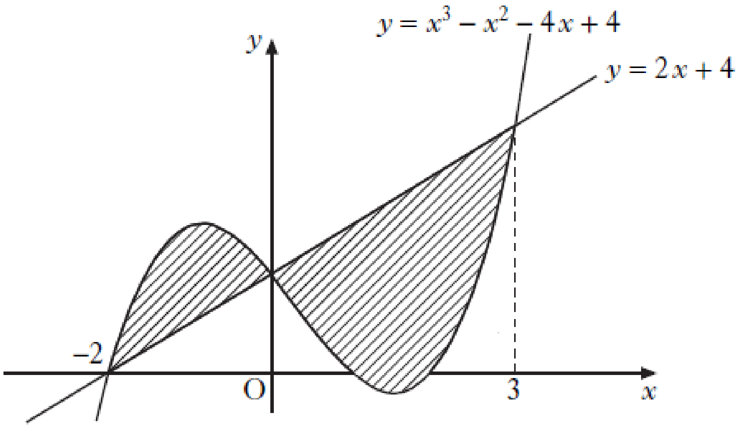
The shaded area lies between the lines $y = 14$ and $y = 24$.

Calculate the shaded area.



12. The diagram shows the curve with equation $y = x^3 - x^2 - 4x + 4$ and the line with equation $y = 2x + 4$.

The curve and the line intersect at the points (–2, 0), (0, 4) and (3, 10).



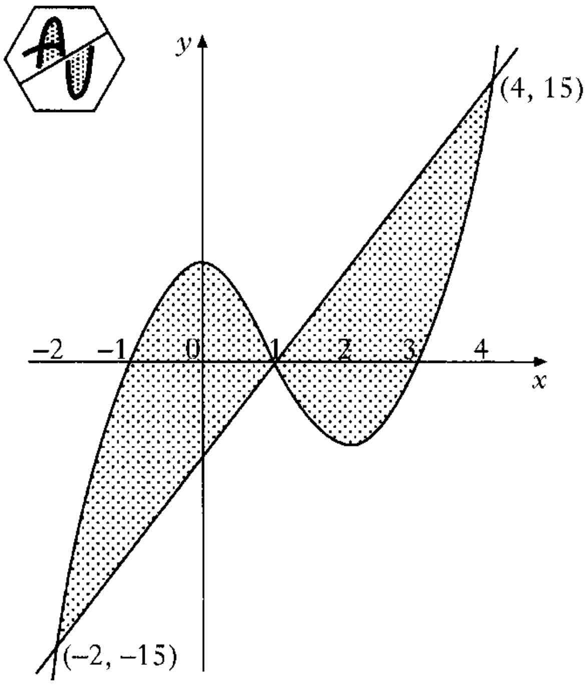
Calculate the total shaded area.

13. A firm asked for a logo to be designed involving the letters A and U. Their initial sketch is shown in the hexagon.

A mathematical representation of the final logo is shown in the coordinate diagram.

The curve has equation $y = (x + 1)(x - 1)(x - 3)$ and the straight line has equation $y = 5x - 5$. The point (1, 0) is the centre of half-turn symmetry.

Calculate the total shaded area.



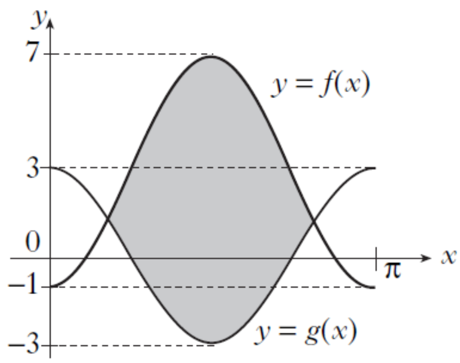
14. The graphs of $y = f(x)$ and $y = g(x)$ are shown in the diagram.

$f(x) = -4\cos(2x) + 3$ and $g(x)$ is of the form $g(x) = m\cos(nx)$.

(*a*) Write down the values of m and n.

(*b*) Find, correct to one decimal place, the coordinates of the points of intersection of the two graphs in the interval $0 \le x \le \pi$.

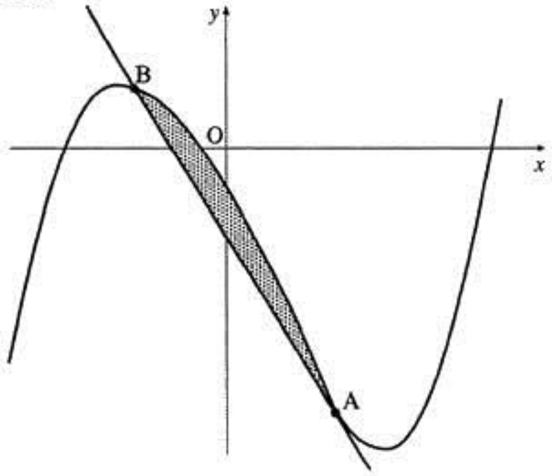
(*c*) Calculate the shaded area.



15. In the diagram below a winding river has been modelled by the curve $y = x^3 - x^2 - 6x - 2$ and a road has been modelled by the straight line AB. The road is a tangent to the river at the point A(1, – 8).

(*a*) Find the equation of the tangent at A and hence find the coordinates of B. **(8)**

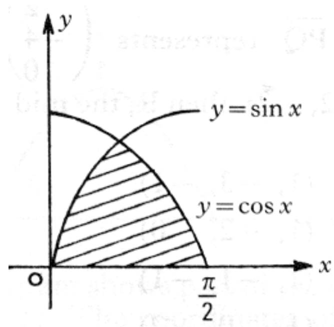
(*b*) Find the area of the shaded part which represents the land bounded by the river and the road. **(3)**



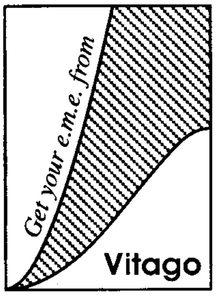
16. The diagram shows the graphs of the curve $y = 2\sqrt{x}$ and the straight line $y = x - 3$.

(a) Prove, by solving an equation, that the line and curve meet when x = 1 and x = 9.

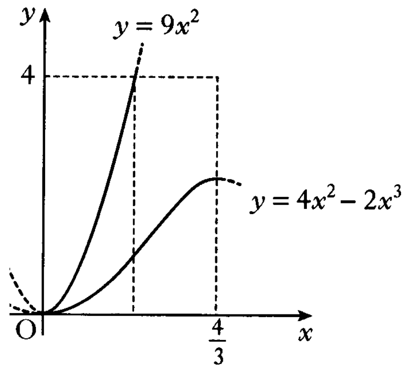
(b) Hence find the shaded area between the curve and the line.



19. The diagram shows the front of a packet of Vitago, a new vitamin preparation to provide early morning energy. The shaded region is red and the rest yellow.



The design was created by drawing the curves $y = 9x^2$ and $y = 4x^2 - 2x^3$ as shown in the diagram below.



The edges of the packet are represented by the coordinate axes and the lines $x = \frac{4}{3}$ and $y = 4$.

Show that $\frac{160}{81}$ of the front of the packet is red.

20. a) Find the x-values of the three points of intersection for these curves, for $0 \leq x \leq 2\pi$.

b) Calculate the area enclosed by the curves.