Higher Mathematics

Integration - **Questions** - 2013-2019

Marks are indicated in brackets after each question number

2013 Paper 1 Question 7, (2)

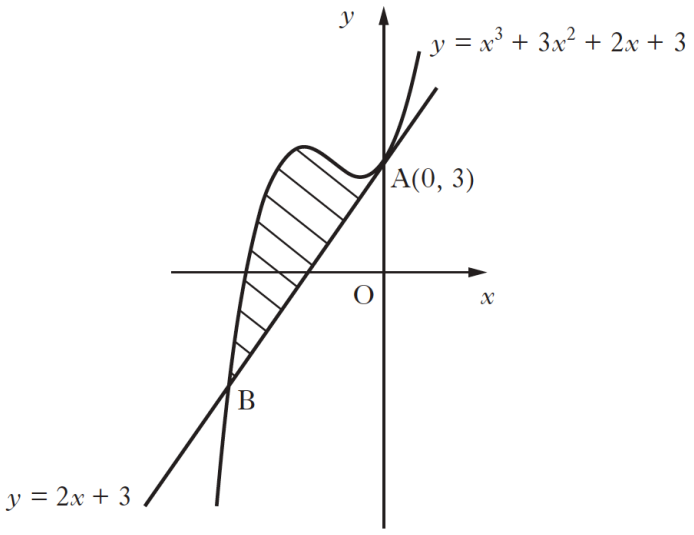
Find $\int x(3x + 2)\,dx$.

2013 Paper 1 Question 16, (2)

Find $\int (1-6x)^{-\frac{1}{2}} dx$ where $x < \frac{1}{6}$.

2013 Paper 2 Question 4, (6)

The line with equation $y = 2x + 3$ is a tangent to the curve with equation $y = x^3 + 3x^2 + 2x + 3$ at A(0, 3), as shown in the diagram.



The line meets the curve again at B.

Show that B is the point (–3, –3) and find the area enclosed by the line and the curve.

2013 Paper 2 Question 6, (5)

Given that $\int_0^a 5\sin 3x \, dx = \frac{10}{3}, \quad 0 \leq a < \pi,$

calculate the value of a.

2014 Paper 1 Question 5, (2)

Find $\int (2x+9)^5 \, dx$.

2014 Paper 2 Question 5, (5)

Given that $\int_4^t (3x+4)^{-\frac{1}{2}} \, dx = 2$, find the value of t.

2014 Paper 2 Question 7, (5) (5)

Land enclosed between a path and a railway line is being developed for housing.
This land is represented by the shaded area shown in Diagram 1.

- The path is represented by a parabola with equation $y = 6x - x^2$.
- The railway is represented by a line with equation $y = 2x$.
- One square unit in the diagram represents 300 m^2 of land.

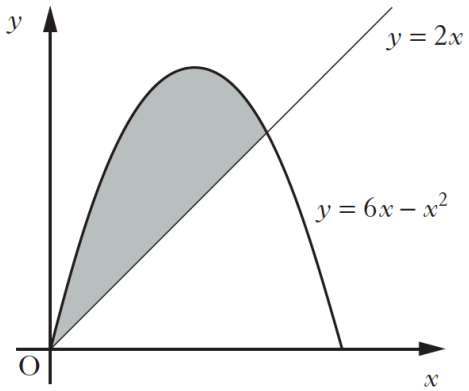


Diagram 1

(*a*) Calculate the area of land being developed.

A road is built parallel to the railway line and is a tangent to the path as shown in Diagram 2.

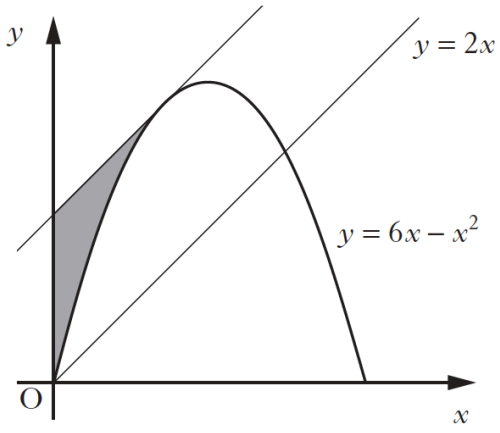


Diagram 2

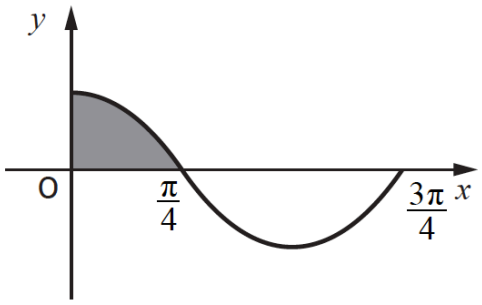
It is decided that the land, represented by the shaded area in Diagram 2, will become a car park.

Calculate the area of the car park.

2015 Paper 1 Question 12, (4)

The diagram shows part of the graph of $y = a\cos bx$.

The shaded area is $\frac{1}{2}$ unit².

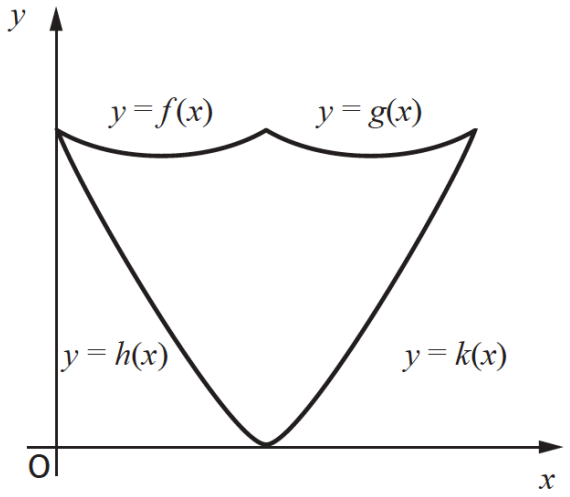


What is the value of $\int_0^{\frac{3\pi}{4}} (a\cos bx)dx$?

2015 Paper 2 Question 4, (2) (7)

A wall plaque is to be made to commemorate the 150th anniversary of the publication of "*Alice's Adventures in Wonderland*".

The edges of the wall plaque can be modelled by parts of the graphs of four quadratic functions as shown in the sketch.



- $f(x)=\frac{1}{4}x^2-\frac{1}{2}x+3$
- $g(x)=\frac{1}{4}x^2-\frac{3}{2}x+5$
- $h(x)=\frac{3}{8}x^2-\frac{9}{4}x+3$
- $k(x)=\frac{3}{8}x^2-\frac{3}{4}x$

(a) Find the x-coordinate of the point of intersection of the graphs with equations $y=f(x)$ and $y=g(x)$.

The graphs of the functions $f(x)$ and $h(x)$ intersect on the y-axis.

The plaque has a vertical line of symmetry.

(b) Calculate the area of the wall plaque.

2015 Paper 2 Question 7, (2) (2) (2)

(a) Find $\int (3\cos 2x + 1)\,dx$.

(b) Show that $3\cos 2x + 1 = 4\cos^2 x - 2\sin^2 x$.

(c) Hence, or otherwise, find $\int (\sin^2 x - 2\cos^2 x)\,dx$.

2016 Paper 1 Question 5, (2)

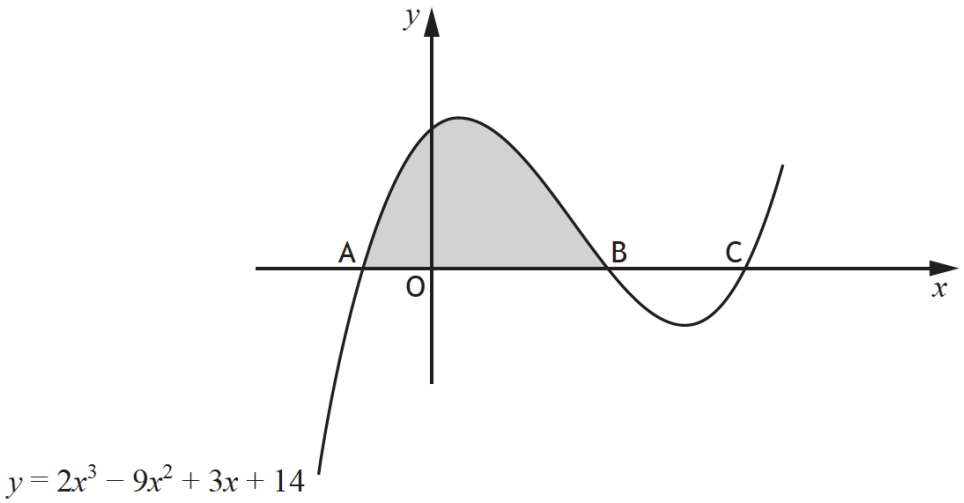
Find $\int 8\cos(4x+1)\,dx$.

2016 Paper 2 Question 3, (2) (3) (1) (4)

(a) (i) Show that $(x+1)$ is a factor of $2x^3 - 9x^2 + 3x + 14$.

(ii) Hence solve the equation $2x^3 - 9x^2 + 3x + 14 = 0$.

(b) The diagram below shows the graph with equation $y = 2x^3 - 9x^2 + 3x + 14$.
The curve cuts the x-axis at A, B and C.



(i) Write down the coordinates of the points A and B.

(ii) Hence calculate the shaded area in the diagram.

2016 Paper 2 Question 9, (4)

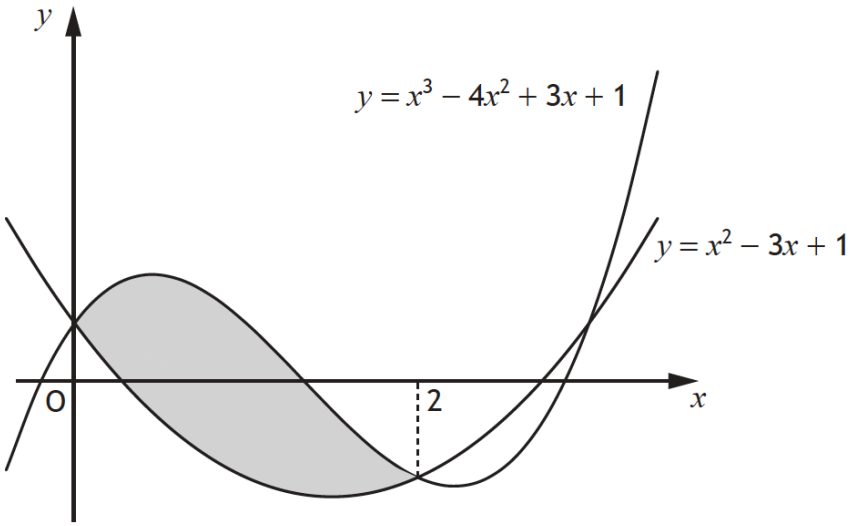
For a function f, defined on a suitable domain, it is known that:

- $f'(x) = \dfrac{2x+1}{\sqrt{x}}$
- $f(9) = 40$

Express $f(x)$ in terms of x.

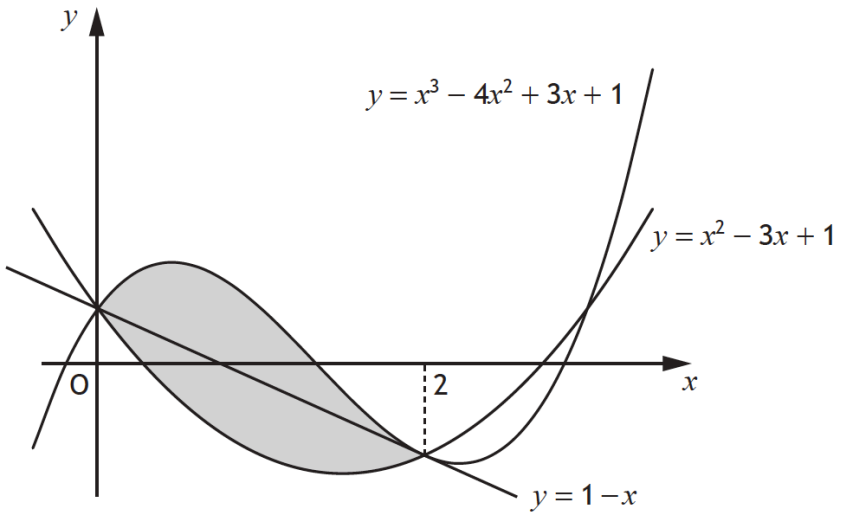
2017 Paper 1 Question 10, (5) (4)

Two curves with equations $y = x^3 - 4x^2 + 3x + 1$ and $y = x^2 - 3x + 1$ intersect as shown in the diagram.



(a) Calculate the shaded area.

The line passing through the points of intersection of the curves has equation $y = 1 - x$.



(b) Determine the fraction of the shaded area which lies below the line $y = 1 - x$.

2017 Paper 1 Question 13, (4)

Find $\int \frac{1}{(5-4x)^{\frac{1}{2}}} dx, \quad x < \frac{5}{4}.$