IB Maths: AA HL

Integration

Topic Questions

These practice questions can be used by students and teachers and is Suitable for IB Maths AA HL Topic Questions

Course	IB Maths
Section	5. Calculus
Topic	5.3 Integration
Difficulty	Medium

Level: IB Maths

Subject: IB Maths AA HL

Board: IB Maths

Topic: Integration

Question 1

(a) Show that

$$(3-2x)^2 = 9 - 12x + 4x^2$$

[2 marks]

(b) Hence, or otherwise, find the indefinite integral for the following:

$$\int (3-2x)^2 \, dx$$

[2 marks]

Question 2

Given

$$\int_k^5 (2x-1) \, dx = 20$$

find the value of the positive constant k.

[4 marks]

Question 3

A curve $y = f(x)$ passes through point $A(4, 2)$ and has a gradient of $f'(x) = 5x - 2$.

(a) Find the gradient of the curve at point A.

[2 marks]

(b) Find the equation of the tangent to the curve at point A.
Give your answer in the form $y = mx + c$.

[2 marks]

(c) Determine the equation of the curve $y = f(x)$.

[3 marks]

Question 4

A point $P(3, 8)$ lies on the curve $y = f(x)$ that has a gradient of $f'(x) = -2x^2 + 11$.

(a) Find the gradient of the curve at point P.

[2 marks]

(b) Find the equation of the tangent to the curve at point P.
Give your answer in the form $y = mx + c$.

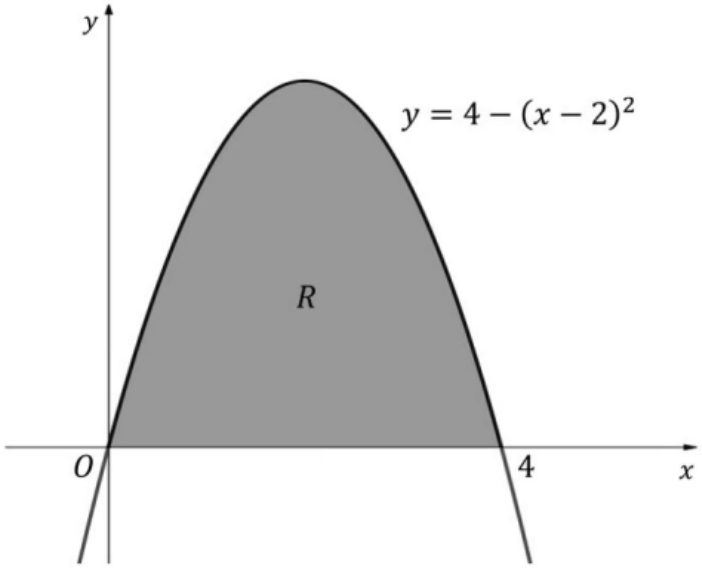
[2 marks]

(c) Determine the equation of the curve $y = f(x)$.

[3 marks]

Question 5

The diagram below shows part of the graph of $y = 4 - (x - 2)^2$.



(a) Write down the values of x where $y = 0$.

[1 mark]

(b) Show that

$$4 - (x - 2)^2 = 4x - x^2$$

[1 mark]

(c) Evaluate

$$\int_0^4 (4x - x^2)\,dx$$

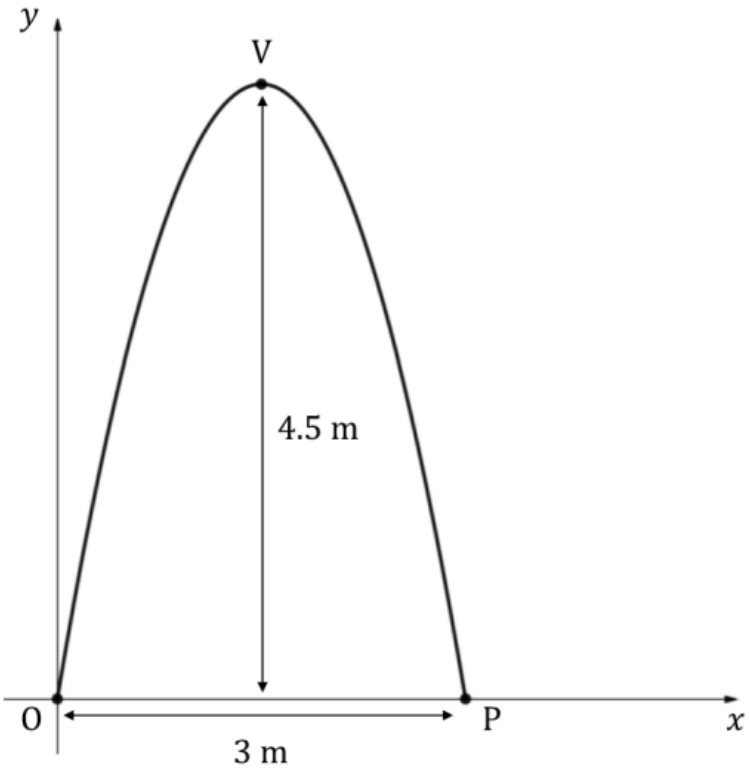
[2 marks]

(d) Write down the area of the region labelled R.

[1 mark]

Question 6

The following diagram shows an arch that is 4.5 m tall and 3 m wide. The arch crosses the x-axis at the origin, O, and at point P, and its vertex is at point V. The arch may be represented by a curve with an equation of the form $y = x(ax + 6)$, where all units are measured in metres.



(a) Find

(i) the coordinates of P

(ii) the coordinates of V

(iii) the value of a.

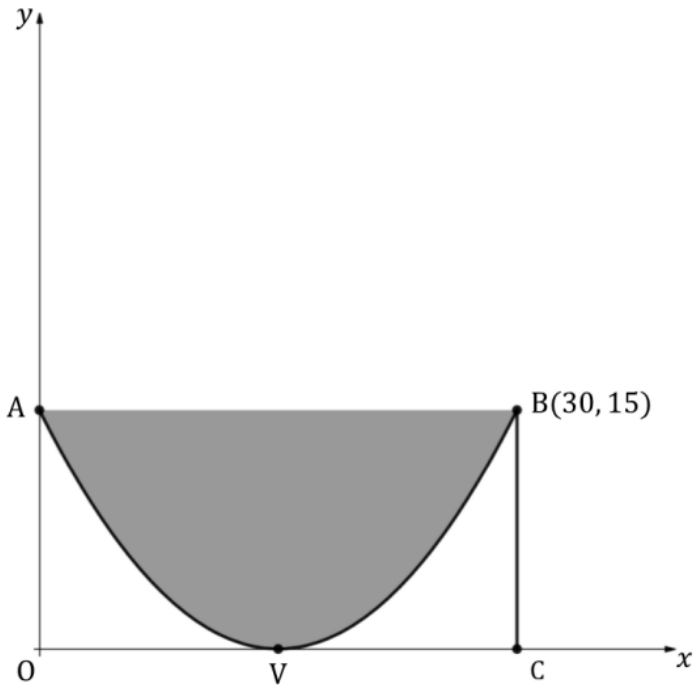
[4 marks]

(b) Find the cross-sectional area under the arch.

[2 marks]

Question 7

A trough has a cross-sectional area shown by the shaded region of the diagram below, where the x and y values are in centimetres. The curved bottom of the trough has an equation in the form $y = r(x - 15)^2$. Point O is the origin, and points O, A, B and C are the vertices of a rectangle. Point V, the deepest point of the trough, is situated on the x-axis.



(a) Determine the value of r.

[2 marks]

(b) Find the cross-sectional area of the trough.

[4 marks]

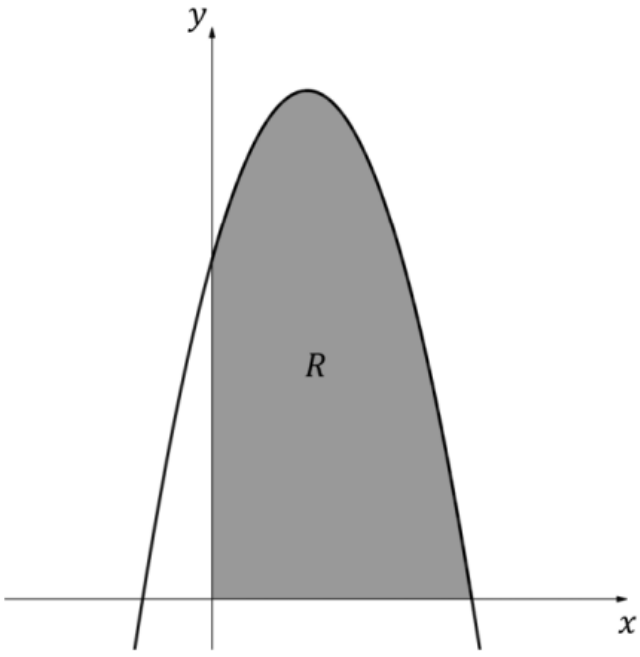
The length of the trough is 1.2 m.

(c) Find the volume of the trough. Give your answer in cm^3.

[2 marks]

Question 8

The following diagram shows part of the graph of $f(x) = (5 - 2x)(2 + 3x)$, $x \in \mathbb{R}$. The shaded region R is bounded by the x-axis, the y-axis and the graph of f.



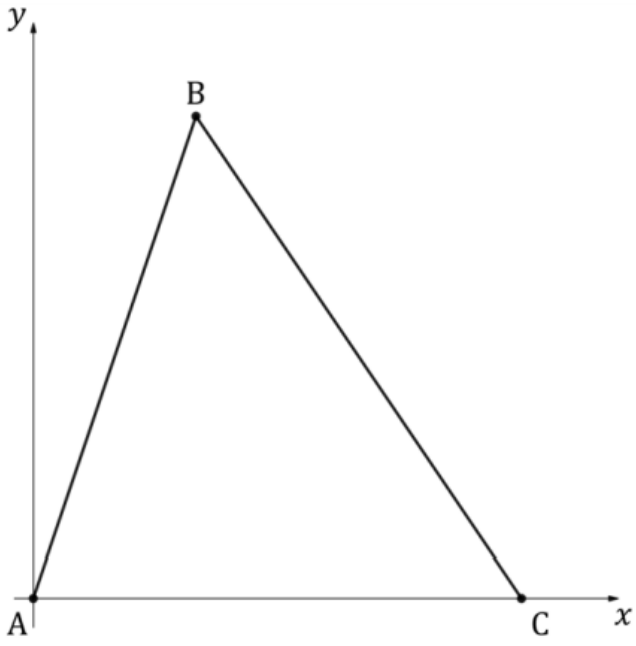
(a) Write down an integral for the area of region R.

[2 marks]

(b) Find the area of region R.

[1 mark]

The three points $A(0,0)$, $B(4,h)$ and $C(9,0)$ define the vertices of a triangle.



(c) Find the value of h, the y-coordinate of B, given that the area of the triangle is equal to the area of region R.

[2 marks]