

Question 9

Consider the following derivative information for the function $f(x)$:

$$f'(x) > 0 \text{ for } x < 3$$

$$f'(x) = 0 \text{ at } x = 3$$

$$f'(x) > 0 \text{ for } x > 3$$

State the **nature** and the **location** of the stationary point.

Question 10

Differentiate: $y = \frac{x^2 - x^3}{x} + \pi$, with respect to x .

Question

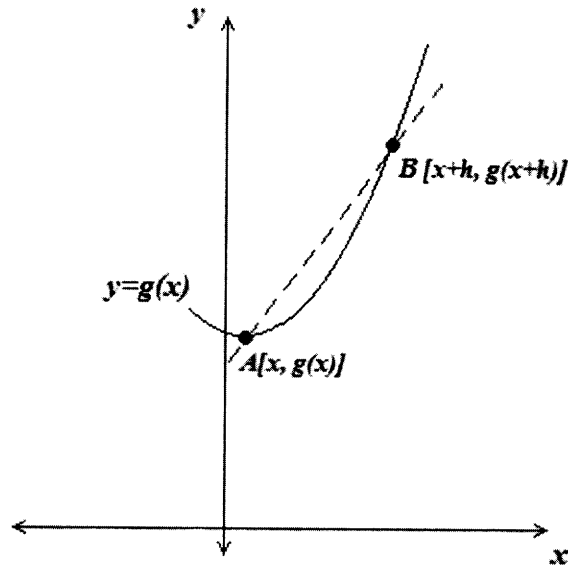
Differentiate the function $f(x) = x^2 - 4x + 7$ from **First Principles**.

Section C (continued)

Question 12

(5 marks)

For
Marker
Use
Only



- (a) Determine a fully simplified expression for the **gradient** of the **line segment through AB** on the curve $g(x) = 5 + \pi x^2$ as shown in the diagram above.

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Question 12 continues opposite.

Question 12 (continued)

**For
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(b) What is the limiting condition that must be applied to determine an expression for $g'(x)$?

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(c) Apply this limiting condition to your simplified expression from (a), to determine by first principles an expression for $g'(x)$ and hence an exact value for $g'(3)$.

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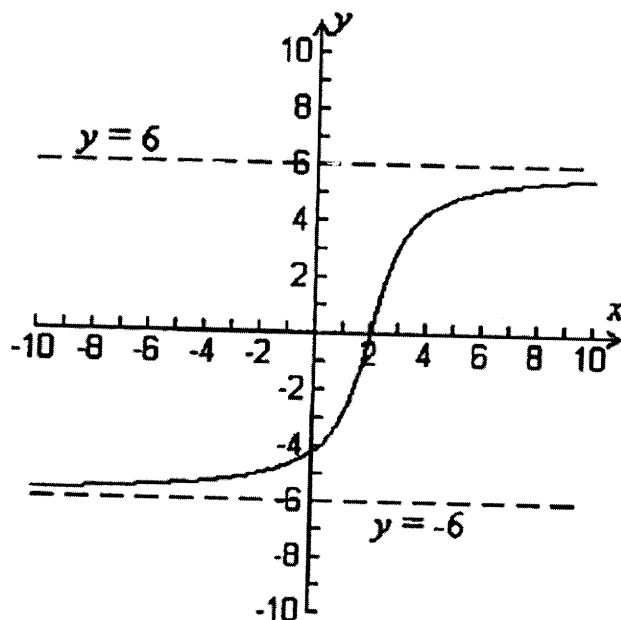
No calculators

Question

Find the co-ordinates of the points on the curve with equation: $y = 2x^3 + 3x^2 - 12x + 7$ where the tangents are horizontal

Question

A particular function $g(x)$ has a graph as shown below. On the same axes, roughly sketch a graph of the derivative $g'(x)$. (4 marks)



No Calculators

Question

If $h'(x) = 4x^2 - 3x - 2$ and $h(-2) = 1$, then determine the function $h(x)$.

Question

The function $f(x) = 2x^2 + 3x + a$ has a tangent $y = 5 - x$. Determine the value of a .

Section C (continued)

Question 12

(4 marks)

**For
Marker
Use
Only**

The velocity $v(t)$, measured in kilometres per hour, of a dragster t seconds after starting a race is given by $v(t) = 0.8(200t - t^4)$. The acceleration of an object is given by $a(t) = v'(t)$.

(a) Determine an expression for the acceleration of the dragster.

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(b) Determine the acceleration of the dragster five seconds after the race begins and explain the significance of the sign of the acceleration. Include appropriate units.

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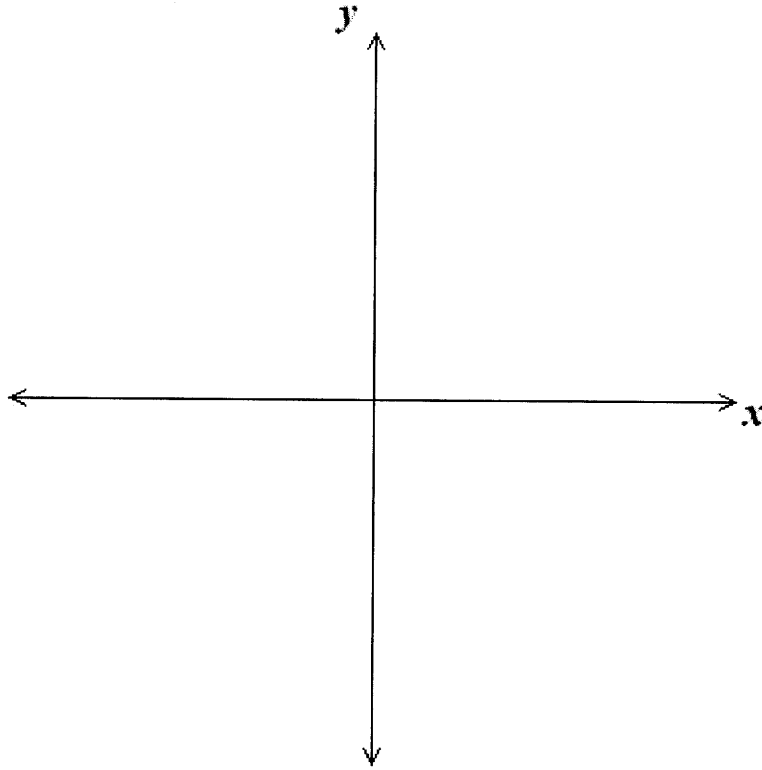
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Section C (continued)

**For
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Use
Only**

Question 11

Sketch the graph of $y = 4x^2 - x^4$ on the axes provided. Clearly label all intercepts and stationary points with exact values. (3 marks)



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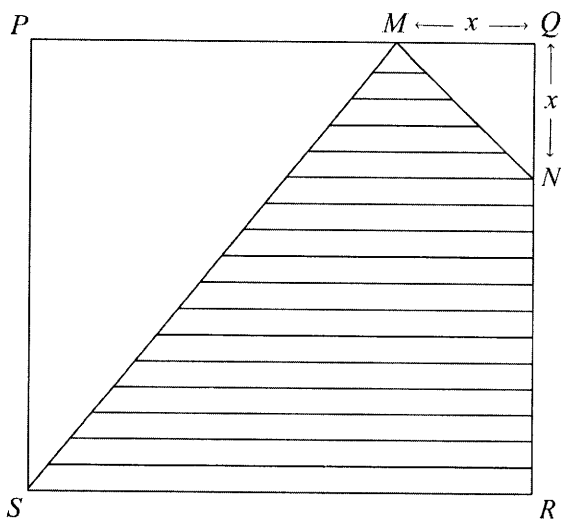
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Section C continues over the page.

Question 11

$PQRS$ is a square of side length 4 metres. The lengths MQ and QN are each x metres.



- a. Write down an expression for the length PM in terms of x .

_____ 1 mark

- b. Show that the shaded area, A , is given by $A = 8 + 2x - \frac{1}{2}x^2$.

- c. Find the maximum value of A .

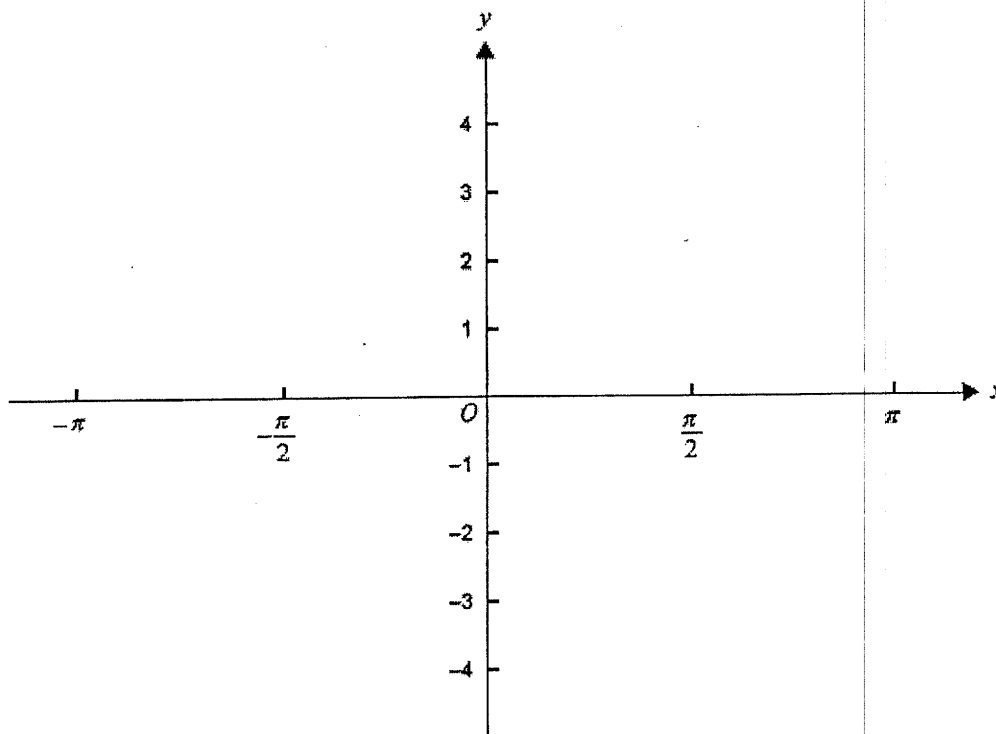
2 marks
 Total 4 marks

10. For the function
 $f : [-\pi, \pi] \rightarrow \mathbb{R}, f(x) = -3 \cos(2x)$

a. write down the period and the amplitude of the function

2 marks

b. sketch the graph of the function f on the set of axes below. Label the intercepts and any endpoints with their co-ordinates.



2 marks

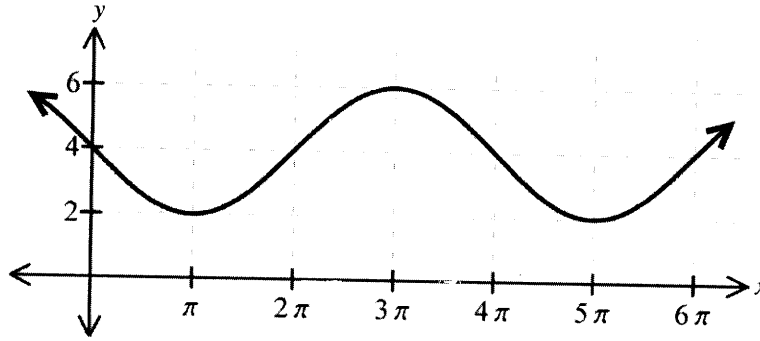
Section B (continued)

Question 10

The graph below is of the form $y = a \sin(bx) + c$.

(3 marks)

**For
Marker
Use
Only**



Find the exact values of a , b and c .

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Section B

**For
Marker
Use
Only**

Answer **ALL** questions in this section.

This section assesses **Criterion 4**.

Question 5

(2 marks)

- (a) Convert $\frac{3\pi}{5}$ radians into degrees.

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- (b) Convert 18° into radians.

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Question 6

(2 marks)

Evaluate $\tan \frac{5\pi}{6} + \cos \frac{-\pi}{4}$.

Express answer as an exact value.

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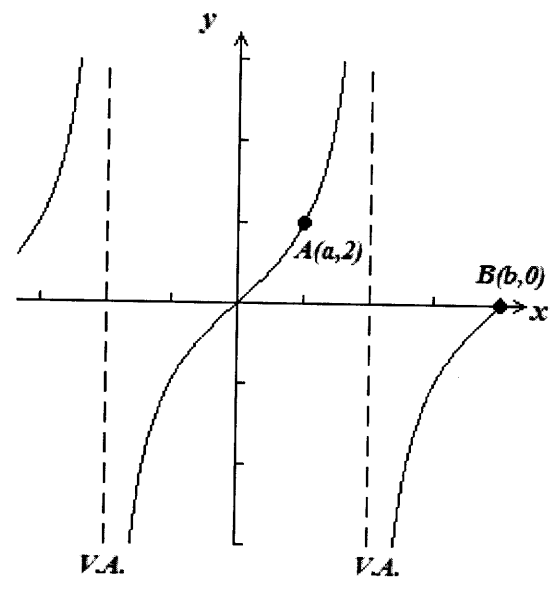
Section B continues opposite.

Section B (continued)

Question 7

(3 marks)

**For
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Use
Only**



The sketch above is of the function $y = 2 \tan\left(\frac{x}{3}\right)$.

Point *A* has co-ordinates $(a, 2)$.

Point *B* has co-ordinates $(b, 0)$.

(a) Find the exact values of *a* and *b*.

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(b) Determine the exact values for the asymptotes shown.

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Section B continues over the page.

Section B

**For
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Use
Only**

Answer **ALL** questions in this section.

This section assesses **Criterion 5**.

Question 5

(4 marks)

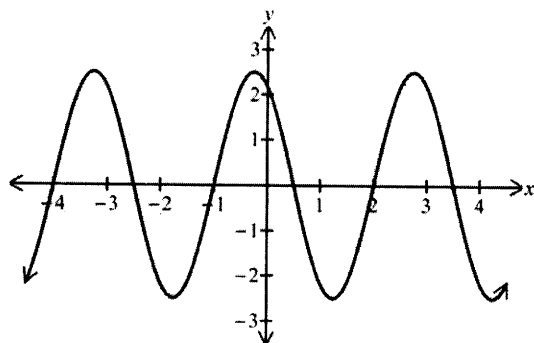
State the exact value of the period and amplitude of:

- (a) the function $f(x) = 4 - \sin(6x)$

Period

Amplitude

- (b) the graph



Period

Amplitude

Question 6

(2 marks)

If $\cos \theta = 0.3$, then determine $1 - \cos^2\left(\frac{\pi}{2} - \theta\right)$.

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Section B continues.

Section B

**For
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Use
Only**

Answer **ALL** questions in this section.

This section assesses **Criterion 5**.

Question 5

(4 marks)

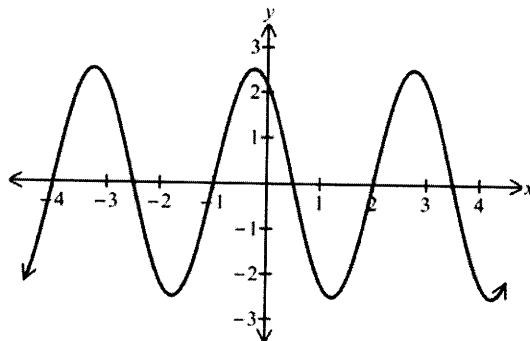
State the exact value of the period and amplitude of:

- (a) the function $f(x) = 4 - \sin(6x)$

Period

Amplitude

- (b) the graph



Period

Amplitude

Question 6

(2 marks)

If $\cos \theta = 0.3$, then determine $1 - \cos^2\left(\frac{\pi}{2} - \theta\right)$.

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Section B continues.

Section B (continued)

Question 8

(5 marks)

**For
Marker
Use
Only**

$$\text{Given } \sin\left(\frac{5\pi}{4}\right) + \tan(2\theta) + \cos\left(-\frac{\pi}{6}\right) = \frac{\sqrt{3}}{6} - \frac{\sqrt{2}}{2},$$

determine **exact values** for θ , if $-\pi \leq \theta \leq \pi$.

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Question

Water is being collected in a tank. The volume V cubic metres of water in the tank after t minutes is given by: $V = 2t^2 - 3t + 1$. Find:

- a. The average rate of change of V between $t = 1$ and $t = 3$.

- b. The instantaneous rate of change of V at $t = 3$.

Question

The line with equation $y = 4x - 5$ is tangent to the curve $y = x^4 + c$. Find the value of c .

Question

If $f(x) = -\frac{3}{2}\sin(2x) + \frac{3}{4}$, find the smallest value of x so that $f(x) = 0$ for $x \in [0, 2\pi]$

Question 10

a. If $f: [0, \pi] \rightarrow \mathbb{R}$, $f(x) = 3 - 2 \cos\left(\frac{x}{2}\right)$.

i. State the amplitude and period of f .

ii. Determine the range of f .

2 + 2 = 4 marks

b. Solve the equation $2 \sin(x) = -1$ for $x \in [-\pi, \pi]$.

3 marks

Question

Solve the equation:

$$\tan(3x) = -1 \text{ for } -\pi < x < \pi$$

Question

$$\text{Solve the equation: } 2 \sin(2x) + \sqrt{3} = 0 \text{ for } 0 < x < \pi$$

Question 9

a. Solve the equation $3 \sin\left(\frac{x}{2}\right) - \frac{3}{2} = 0$ for $x \in [-\pi, 2\pi]$.

2 marks

b. What is the average rate of change of $f(x) = -3 \sin\left(\frac{x}{2}\right)$ between $x = -\pi$ and $x = \pi$?

2 marks

c. If $\cos(x) = 0.7$, where $0 < x < \frac{\pi}{2}$, evaluate $\cos(2\pi - x) - \cos(\pi + x)$.

2 marks

Total 6 marks

7. Given that $\sin \theta = -\frac{5}{13}$ and $\frac{3}{2}\pi < \theta < 2\pi$, find the value of $\cos \theta$

3 marks

8. If $f(x) = \frac{\sqrt{x}}{3}(x\sqrt{x} + 2x^{\frac{3}{2}})$ find the value of $f'(-3)$

3 marks

9. (i) Find $\int (2-x)^2 dx$

(ii) If $f'(x) = (2-x)^2$, find $f(x)$ given that $f(3) = 0$

3 marks