

MATHEMATICAL METHODS (CAS)

Unit 2 – Written examination 1



2007 Trial Examination

SOLUTIONS

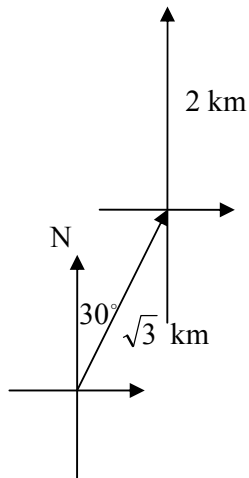
Question 1

- a. Marking scheme: Labelling of distances and known angle

M1

Accurate diagram (angles don't have to be precise)

M1



- b. Solve $d^2 = 2^2 + (\sqrt{3})^2 - 2(2)(\sqrt{3})\cos 150^\circ$

M1

$$= 4 + 3 - 4\sqrt{3}\left(-\frac{\sqrt{3}}{2}\right) = 7 + 6 = 13,$$

$$\text{so } d = \sqrt{13} \text{ km}$$

A1

- c. This is a right triangle, so: $\frac{x}{\sqrt{3}} = \sin 30^\circ \Rightarrow x = \frac{\sqrt{3}}{2}$.

M1

$$\text{Distance walked} = 2 + \frac{\sqrt{3}}{2} \text{ km}$$

A1

Question 2

Remember SOHCAHTOA: Find the missing hypotenuse of this right triangle (5).

a. Therefore, $\sin \theta = \frac{4}{5}$

M1, A1

b. $\cos \theta = \frac{3}{5}$

M1, A1

Question 3

a. Marking scheme: New period marked

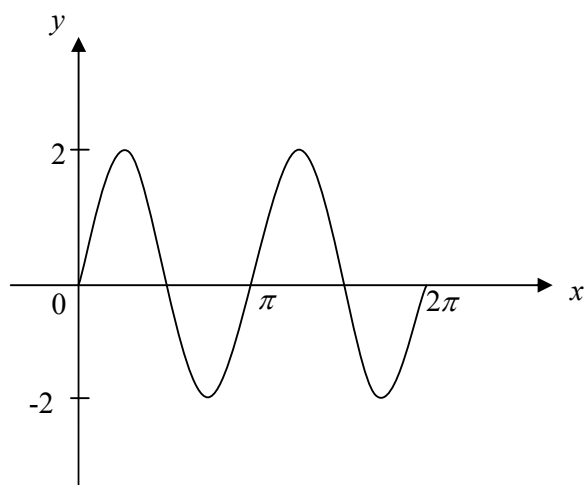
M1

New amplitude indicated

M1

Correct graph

M1



b. Range: $[-2.2]$

A1

Question 4

Marking scheme: Endpoints at $\left(0, \frac{1}{4}\right)$ and $(5, 8)$ marked

M2

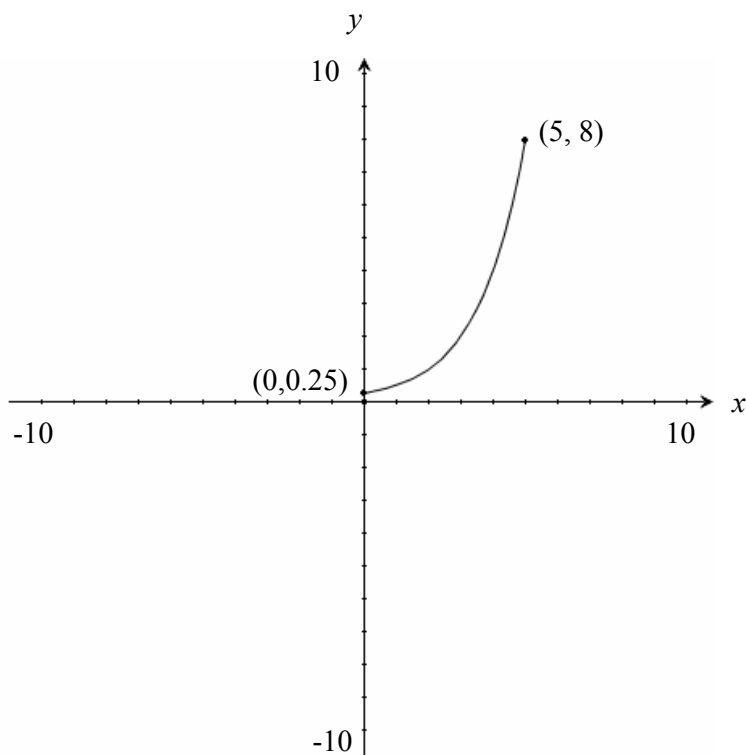
Endpoints are filled in

M1

No other intercepts

Correct graph

M1



Question 5

Marking scheme: Endpoints at (1,0) and (8,6) marked

M2

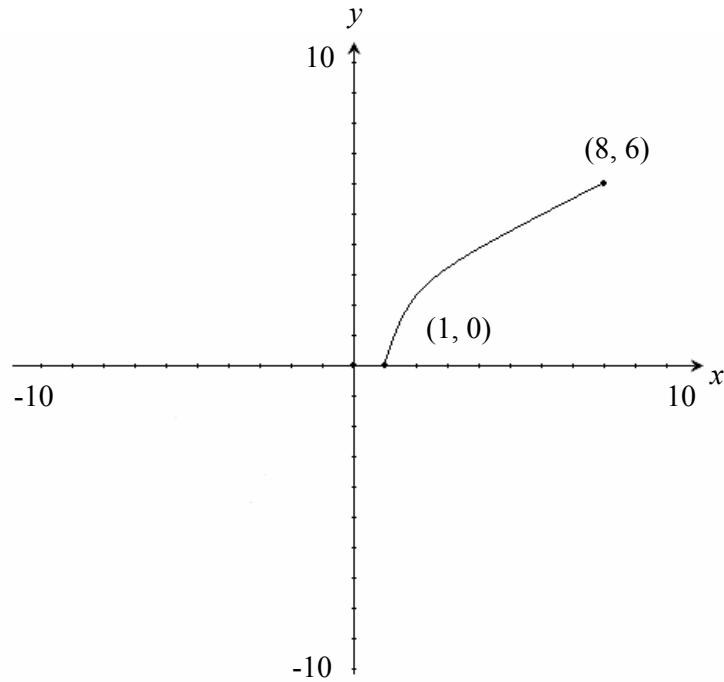
Endpoints are filled in

M1

No intercepts

Correct graph

M1



Question 6

$$f'(x) = 3\sqrt{3}(3)x^2 + 2 - 0 - 3x^{-2} = 9\sqrt{3}x^2 + 2 - 3x^{-2}$$

M1, A1

Question 7

a. $V'(r) = \frac{4}{3}(3)\pi r^2 = 4\pi r^2$

M1, A1

b. $V'(2.5) = 4\pi(6.25)$

M1

$$= 25\pi \text{ cm}^3 / \text{cm}$$

A1

Question 8First, $f'(x) = 6x - 2$

M1

Solve for $6x - 2 = 0$ to get $x = \frac{1}{3}$

M1

Now find $f\left(\frac{1}{3}\right) = 3\left(\frac{1}{3}\right)^2 - 2\left(\frac{1}{3}\right) + 7 = \frac{1}{3} - \frac{2}{3} + \frac{21}{3} = \frac{20}{3}$, therefore stationary point at $\left(\frac{1}{3}, \frac{20}{3}\right)$

A1

Now test a couple of points: $f'(0) = -2$ and $f'(1) = 6 - 2 = 4$. Therefore, this is a minimum.

A1

Question 9

$$f(x) = \int \left(2x^3 - x^2 - \frac{1}{2}x + 3 \right) dx = \frac{x^4}{2} - \frac{x^3}{3} - \frac{x^2}{4} + 3x + c$$

M1

$$\frac{1}{12} = \frac{1}{2} + \frac{1}{3} - \frac{1}{4} - 3 + c,$$

M1

$$\text{so } c = \frac{5}{2}$$

A1

$$\text{Therefore, } f(x) = \frac{x^4}{2} - \frac{x^3}{3} - \frac{x^2}{4} + 3x + \frac{5}{2}$$

A1

Question 10

$$\Pr(3 \text{ males}) = \frac{{}^5C_3 \times {}^3C_2}{{}^8C_5}$$

M1

$$= \frac{10 \times 3}{56}$$

M1

$$= \frac{30}{56} = \frac{15}{28}$$

A1