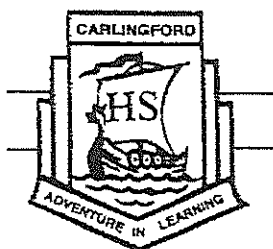


Carlingford High School



Mathematics

Year 10 5.3 Term 1 Examination

2020

Time allowed: 50 minutes

Name: Sol'n Class: 10MAT3__

Please circle Mrs Lobejko Mrs Lego Mr Wilson Ms Aung
your teacher:

Instructions:

- Use blue or black pen
- Pencil may be used for graphs or diagrams only
- Board approved calculators may be used
- No lending or borrowing
- Show all necessary working out in the space provided
- Marks may be deducted for untidy setting out

Topic	Nonlinear Relationships	Surface area	Problem Solving	Total
Mark	/29	/16	/4	/49

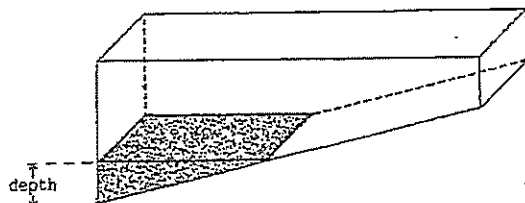
SA Q1-5
PW Q6-9

TL

SA

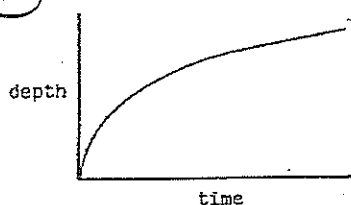
Graphs : 29 mark

1. The swimming pool below has a sloping base. Water is flowing into the pool at a constant rate.

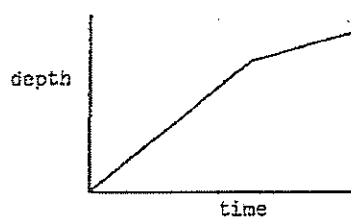


Which graph below best illustrates the change in depth of water with time?

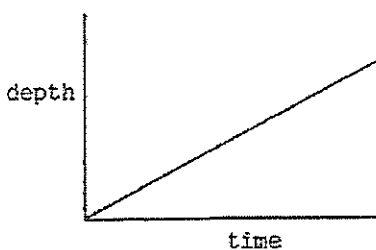
A.



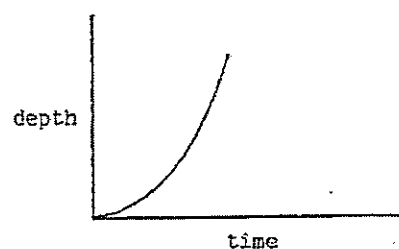
B.



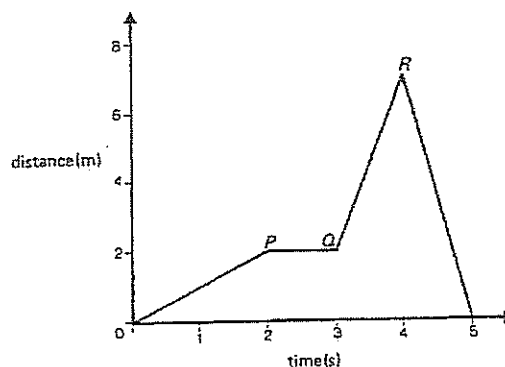
C.



D.



2. The distance-time graph shown below describes the motion of a model train along a straight stretch of track. The train is initially travelling forward.

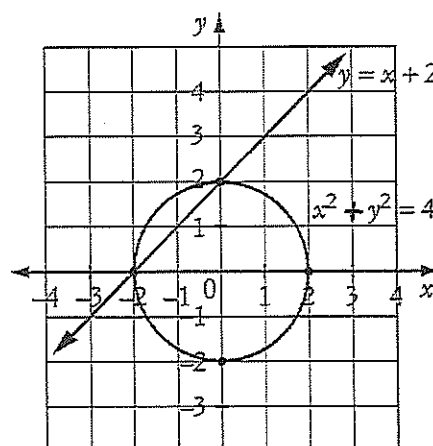


Which of the following statements is **False**?

- A. The portion of the graph labelled *QR* indicates that the train is slowing down.
 B. The portion of the graph labelled *PQ* indicates that the train is stationary.
 C. After 5 seconds the train is back to where it started.
 D. The speed for the train for the first two seconds is 1m/s.

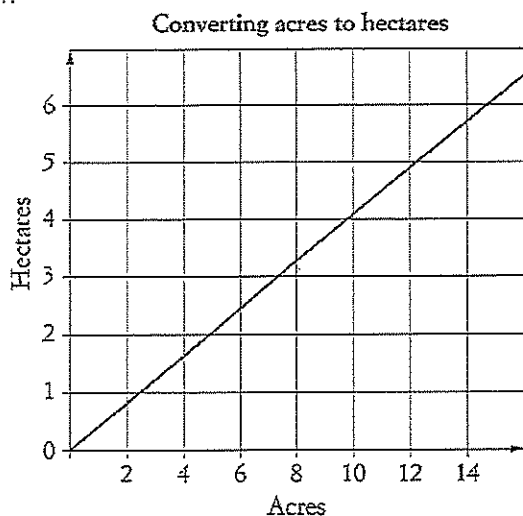
3. Find the point(s) of intersection of [1]

$$y = x + 2 \text{ and } x^2 + y^2 = 4$$



$(-2, 0)$ and $(0, 2)$

4.



The conversion graph above is used to convert acres to hectares. The acre is an Imperial measure of land area while the hectare is the metric measure.

- a) Mrs Lego has a property with an area of 5 acres. How big is this in hectares? [1]

2 hectares

- b) A rectangular playing field measures 250 m by 160 m. What is the area in acres? [1]

$$250 \times 160 = 40\,000 \text{ m}^2$$

$$= 4 \text{ hectares}$$

$\therefore 10 \text{ acres}$

5. For the following parabola:

$$y = 4x^2 - 4x - 3$$

Find:

- a) the y-intercept. [1]

$$(0, -3)$$

or y-intercept is -3

must be in point form

- b) the x-intercepts. [2]

$$0 = 4x^2 - 4x - 3$$

$$0 = (2x+1)(2x-3)$$

$$2x+1=0$$

$$x = -\frac{1}{2}$$

$$2x-3=0$$

$$x = \frac{3}{2}$$

$$\therefore (-\frac{1}{2}, 0) \text{ and } (\frac{3}{2}, 0)$$

- c) the equation of the axis of symmetry. [1]

$$x = -\frac{b}{2a}$$

$$= \frac{4}{2 \times 2}$$

$$= \frac{1}{2}$$

$$\therefore x = \frac{1}{2}$$

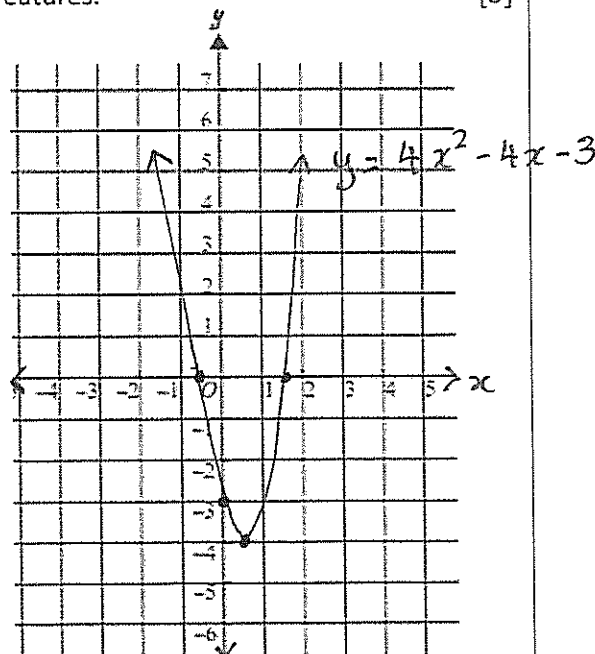
- d) the coordinates of the vertex. [1]

$$y = 4(\frac{1}{2})^2 - 4(\frac{1}{2}) - 3$$

$$= -4$$

$$\therefore (\frac{1}{2}, -4)$$

- e) Hence, sketch its graph showing all these features. [3]



$$y = -3$$

0 marks

6. a) For the circle with equation

$$x^2 + 6x + y^2 - 10y + 30 = 0$$

Find the centre and radius of the circle. [3]

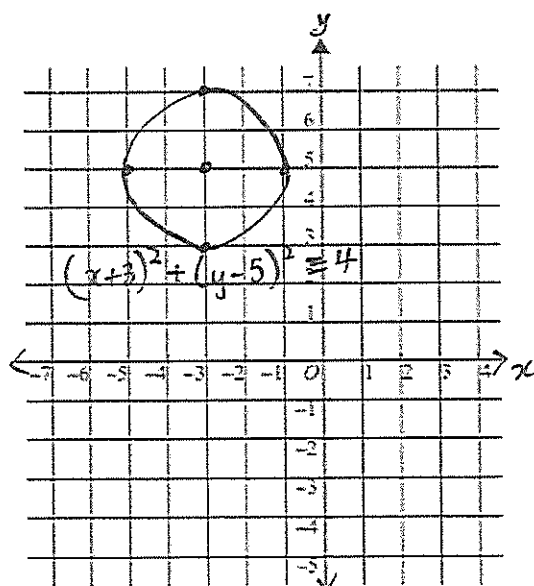
$$x^2 + \frac{6x}{2} + \left(\frac{3}{2}\right)^2 + y^2 - \frac{10y}{2} + \left(\frac{-5}{2}\right)^2 = -30 + 3^2 + (-5)^2$$

$$\textcircled{1} \rightarrow (x+3)^2 + (y-5)^2 = 4$$

$$\textcircled{1} \rightarrow \therefore \text{centre } (-3, 5)$$

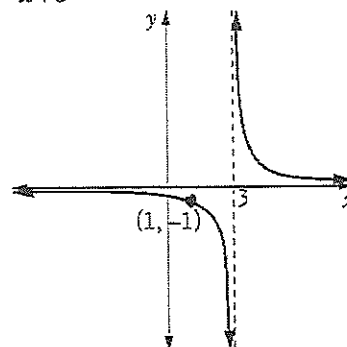
$$\textcircled{1} \rightarrow \text{radius is } 2$$

- b) Hence sketch the circle, showing the centre and radius. [2]



7. The hyperbola below is of the form

$$y = \frac{k}{x+c}$$



- a) Find the values of c and k . [2]

$$c = -3 \leftarrow \textcircled{1}$$

$$y = \frac{k}{x-3}$$

$$-1 = \frac{k}{1-3}$$

$$-1 = \frac{k}{-2}$$

$$2 = k \leftarrow \textcircled{1}$$

- b) State the equation of this hyperbola. [1]

$$y = \frac{2}{x-3}$$

8. Write the equation of the parabola that results from performing the following transformations on the parabola $y = x^2$.

- a) Moving it down 2 units [1]

$$y = x^2 - 2$$

- b) Moving it 3 units to the left. [1]

$$y = (x+3)^2$$

- c) Turning it upside down and then moving it 1 unit up. [1]

$$y = -x^2 + 1$$

9. Choose the most appropriate equation for each of the graphs below.

[5]

$$y = (x + 4)^2$$

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

$$y = -3^x$$

$$y = 9x^2 - 4$$

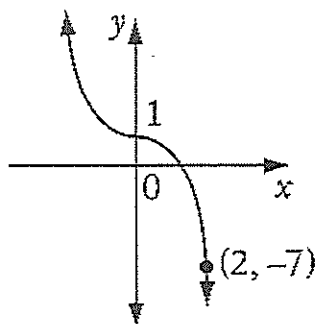
$$y = (x - 3)^3$$

$$y = -x^3 + 1$$

$$y = 3^{-x}$$

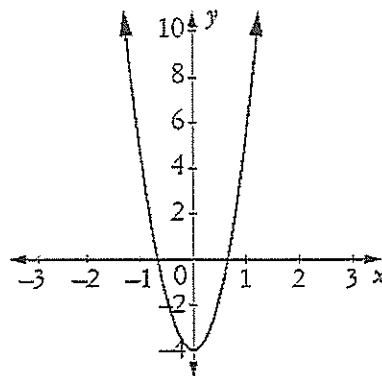
$$y = x^3 + 1$$

a)



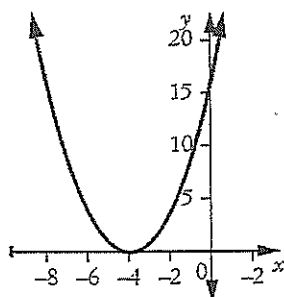
$$y = -x^3 + 1$$

b)



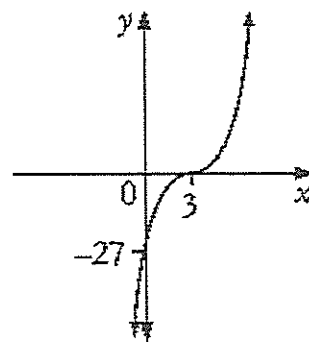
$$y = 9x^2 - 4$$

c)



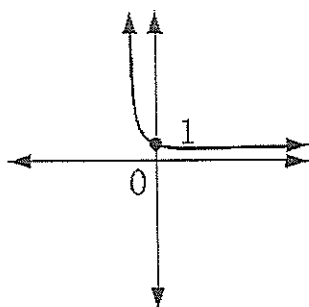
$$y = (x + 4)^2$$

d)



$$y = (x - 3)^3$$

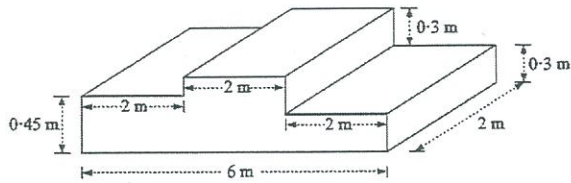
e)



$$y = 3^{-x}$$

Surface Area and Volume: 16 marks

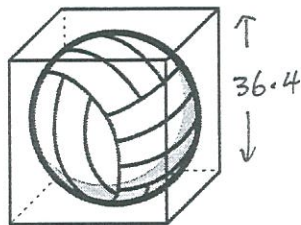
1. This podium is being built for the Olympic Games.



What is the surface area of this podium (including its base)?

- A. 4.8 m^2 B. 5.4 m^2
C. 31.5 m^2 D. 31.8 m^2

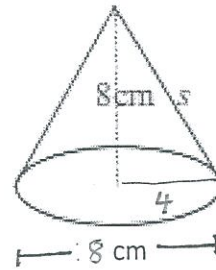
2. A sphere sits exactly inside a cube as shown in the diagram below.



The height of the cube is 36.4 cm. Which expression will give the surface area of the sphere, in cubic centimetres.

- A. $4 \times \pi \times 36.4^2$
B. $4 \times \pi \times 18.2^2$
C. $\frac{4}{3} \times \pi \times 36.4^2$
D. $\frac{4}{3} \times \pi \times 18.2^3$

3. A cone has a diameter of 8 cm and a height of 8 cm.



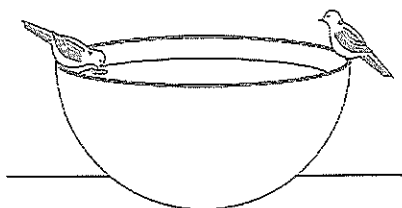
- a) Find the slant height s .
Answer in simplified surd form. [2]

$$\begin{aligned} s &= \sqrt{8^2 + 4^2} \\ &= \sqrt{80} \text{ --- ①} \\ &= 4\sqrt{5} \text{ --- ①} \end{aligned}$$

- b) Find the total surface area of the cone, correct to one decimal places. [2]

$$\begin{aligned} SA &= \pi \times 4^2 + \pi \times 4 \times 4\sqrt{5} \text{ --- ①} \\ &= 162.66\dots \\ &= 162.7 \text{ cm}^2 \end{aligned} \quad \left. \begin{array}{l} \\ \end{array} \right\} \text{either}$$

5. In her garden, Mrs Lego has a birdbath in the shape of a hemisphere. The diameter is 45 cm.



What is the surface area of this birdbath?
Give your answer correct to one decimal place.

[2]

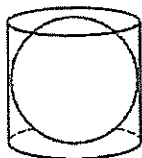
$$SA = \frac{4\pi r^2}{2}$$

$$= \frac{4 \times \pi \times 22.5^2}{2} \rightarrow \textcircled{1}$$

$$= 3180.86 \dots$$

$$= 3180.9 \text{ cm}^2 \quad \left. \vphantom{\begin{matrix} 3180.86 \dots \\ 3180.9 \end{matrix}} \right\} \text{either}$$

6. A sphere fits tightly into a cylinder as shown below.



Show that the ratio of the surface area of the sphere to the surface area of the cylinder is 2 : 3.

[2]

$$4\pi r^2 : 2\pi r^2 + 2\pi rh$$

$$4\pi r^2 : 2\pi r^2 + 2\pi r(2r)$$

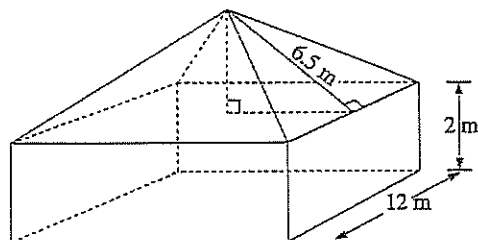
$$4\pi r^2 : 2\pi r^2 + 4\pi r^2$$

$$4\pi r^2 : 6\pi r^2$$

$$4 : 6$$

$$2 : 3$$

7. The roof of this greenhouse is a square pyramid with identical triangular faces. The sides of the greenhouse are rectangles and there is no floor. The dimensions of the greenhouse are shown on the diagram below.



Calculate the surface area of the greenhouse.

[3]

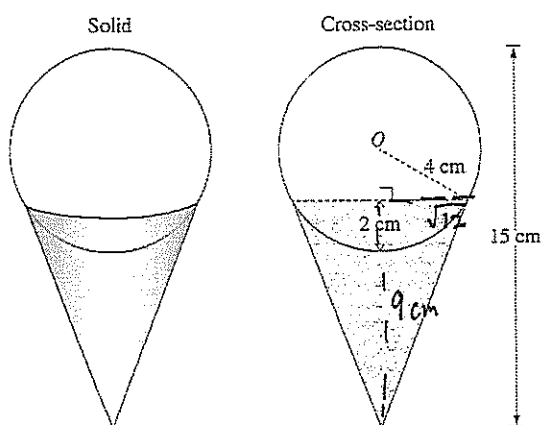
$$SA = 4 \left(\frac{1}{2} \times 12 \times 6.5 \right) + 4(12 \times 2)$$

$$= 252 \text{ m}^2$$

1 mark for

8. A solid is made up of a sphere sitting partially inside a cone.

The sphere, centre O, has a radius of 4 cm and sits 2 cm inside the cone. The solid has a total height of 15 cm. The solid and its cross-section are shown below.



Calculate the curved surface area of the cone, correct to one decimal place? [3]

$$r \text{ of cone} = \sqrt{4^2 - 2^2} \\ = \sqrt{12}$$

$$h \text{ of cone} = 15 - 8 + 2 \\ = 9$$

$$s \text{ of cone} = \sqrt{81 + 12} \\ = \sqrt{93} \quad \text{--- (1)}$$

$$\text{curved area} = \pi \times \sqrt{12} \times \sqrt{93} \\ = 104.9 \text{ cm}^2 \quad \text{--- (1)}$$

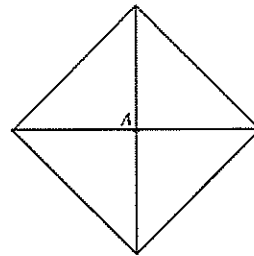
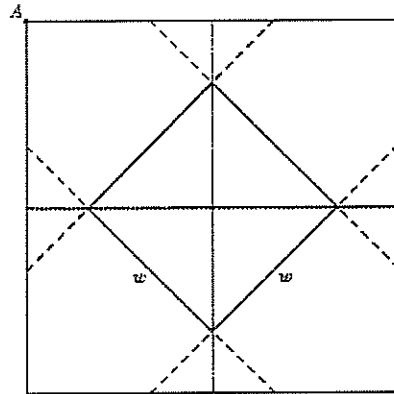
Working space

} (1) either

Problem Solving: 4 marks

1. A closed box with a square base is to be wrapped with a square sheet of wrapping paper. The box is centred on the wrapping paper with the vertices of the base lying on the midlines of the square sheet of paper, as shown in the figure on the left. The four corners of the wrapping paper are to be folded up over the sides and brought together to meet at the centre of the top of the box, point A in the figure on the right. The box has base length w and height h .

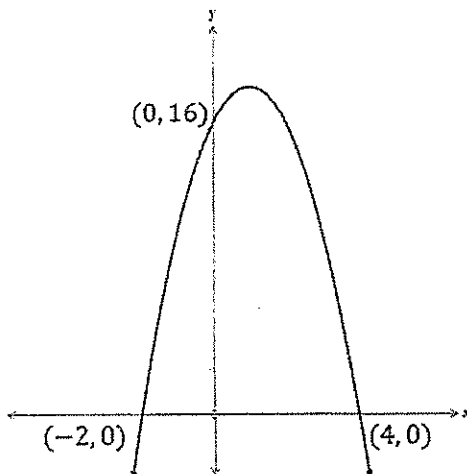
What is the area of the sheet of wrapping paper, in simplest factorised form?



$$2w^2 + 4wh + 2h^2 \quad \text{--- (1)}$$

$$2(w+h)^2 \quad \text{--- (1)}$$

2. If $y = a(x+b)^2 + c$ represents the parabola shown below, find the values of a , b and c .



$$y = a(x-1)(x+2)$$

$$y = a(x^2 - 2x - 8)$$

$$y = a[(x-1)^2 - 9]$$

$$\text{sub } (0, 16) \quad 16 = a[(-1)^2 - 9]$$

$$-2 = a$$

$$\therefore a = -2 \quad b = -1 \quad c = 18$$

