

Sydney Technical High School



Mathematics

YEAR 10 ASSESSMENT TASK 2

SEPTEMBER 2014

Instructions

- Time allowed – **70 minutes**.
- Show necessary working.
- Marks shown are a guide and may need to be adjusted.
- Full marks may not be awarded for careless work or illegible answers.
- Tear off the multiple choice answer sheet from the back of this test to complete Section 1.
- The multiple choice answer sheet will be collected after 15 minutes.

Name: _____

Teacher: _____

Section 1 Multiple Choice	Section 2 Part A Measurement	Section 2 Part B Statistics	Section 2 Part C Similarity	Section 2 Part D Number Plane	Section 2 Part E Miscellaneous	Total
/10	/11	/11	/11	/11	/11	/65

SECTION 1 : MULTIPLE CHOICE

Remove the separate multiple choice answer sheet from the back of this exam to write your answers.

1. The surface area of a sphere of diameter 8cm is closest to:

- (a) 804cm^2 (b) 268cm^2 (c) 201cm^2 (d) 402cm^2

2.

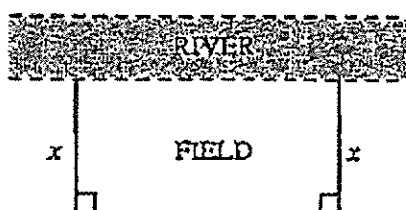
x	f
3	4
5	x
9	3
10	5

The median is 7

The value of x is:

- (a) 2
(b) 4
(c) 7
(d) 10

3.

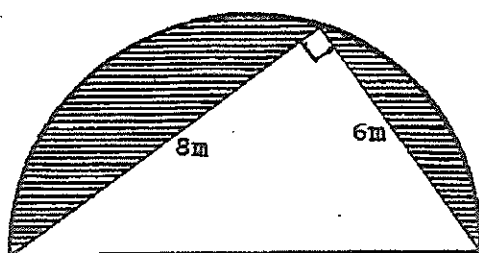


A rectangular field is bounded on one side by a river. It is fenced on the other 3 sides, using 300 metres of fencing.

The area of the field, in square metres, is given by

- (a) $150 - x$
(b) $150 - x^2$
(c) $300 - 2x$
(d) $300x - 2x^2$

4.

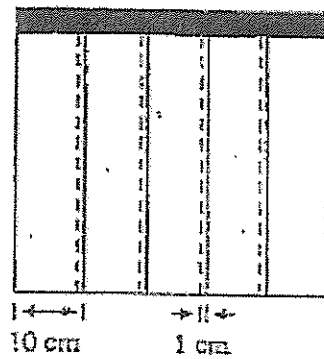


NOT TO SCALE

The diagram shows a semi circle and a triangle. The shaded area is:

- (a) $(25\pi - 24)\text{m}^2$
(b) $(\frac{25\pi}{2} - 48)\text{m}^2$
(c) $(\frac{25\pi}{2} - 24)\text{m}^2$
(d) $(25\pi - 48)\text{m}^2$

5.

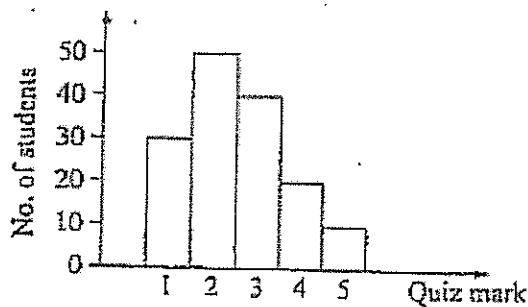


Vertical blinds 10 centimetres wide overlap by 1 centimetre when they are closed.

Which expression represents the width, in centimetres, covered by n blinds when they are closed?

- (a) $9n$
- (b) $9n + 1$
- (c) $10n - 9$
- (d) $10n - 1$

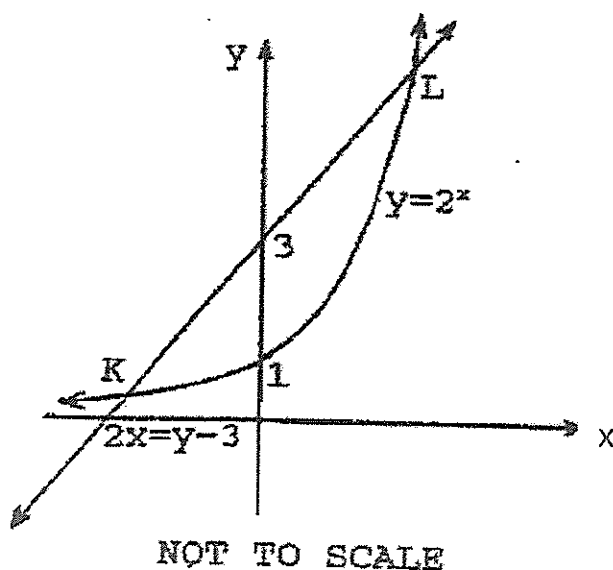
6.



The graph shows the results of 150 students on a maths quiz. Which of the following statements is correct?

- (a) The median is 3
- (b) The mode is 3
- (c) The median is 2
- (d) 50 students got the top score

7.



The points K and L represent the points of intersection of $y = 2^x$ and $2x = y - 3$.

The x values at K and L are the solutions of:

- (a) $2^x + 2x + 3 = 0$
- (b) $2^x - 2x + 3 = 0$
- (c) $2^x + 2x - 3 = 0$
- (d) $2^x - 2x - 3 = 0$

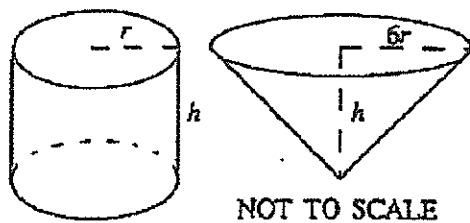
8.

Score	Frequency
11	5
12	4
13	1
14	6
15	4

A score of 13 is added to this sample. Which measure will change?

- (a) median
- (b) range
- (c) mode
- (d) mean

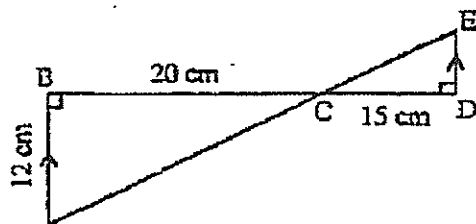
9.



What is the ratio of the volume of the cylinder to the volume of the cone?

- (a) 1:36
- (b) 1:12
- (c) 1:6
- (d) 1:2

10.



Find the length of DE .

- (a) 7 cm
- (b) 9 cm
- (c) 16 cm
- (d) 25 cm

Name: _____

Teacher: _____

SECTION A: MULTIPLE CHOICE

Instructions:

- Circle the letter that best answers the question
- One mark each

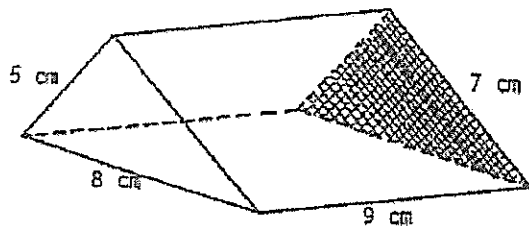
- | | | | | |
|-----|---|---|---|---|
| 1. | A | B | C | D |
| 2. | A | B | C | D |
| 3. | A | B | C | D |
| 4. | A | B | C | D |
| 5. | A | B | C | D |
| 6. | A | B | C | D |
| 7. | A | B | C | D |
| 8. | A | B | C | D |
| 9. | A | B | C | D |
| 10. | A | B | C | D |

SECTION 2 : SHORT ANSWER QUESTIONS

Show your working and write your answers in the space provided. Marks are indicated next to each question.

PART A – SURFACE AREA and VOLUME

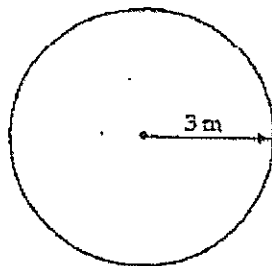
(a)



The area of the shaded end of this triangular prism is 17.5cm^2 . Find the total surface area of the prism.

(1)

(b) (i)

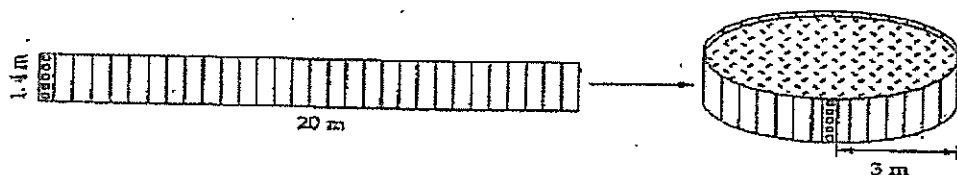


The base of a swimming pool is a circle of radius 3 metres.

Find its area correct to two decimal places.

(1)

The flexible metal sheet drawn below is used to form the wall of the pool



(ii) Find the volume of the pool, correct to the nearest cubic metre.

(1)

(iii) Before a party, the pool is filled with water. After the party, the depth (1)

has dropped to 98 centimetres.

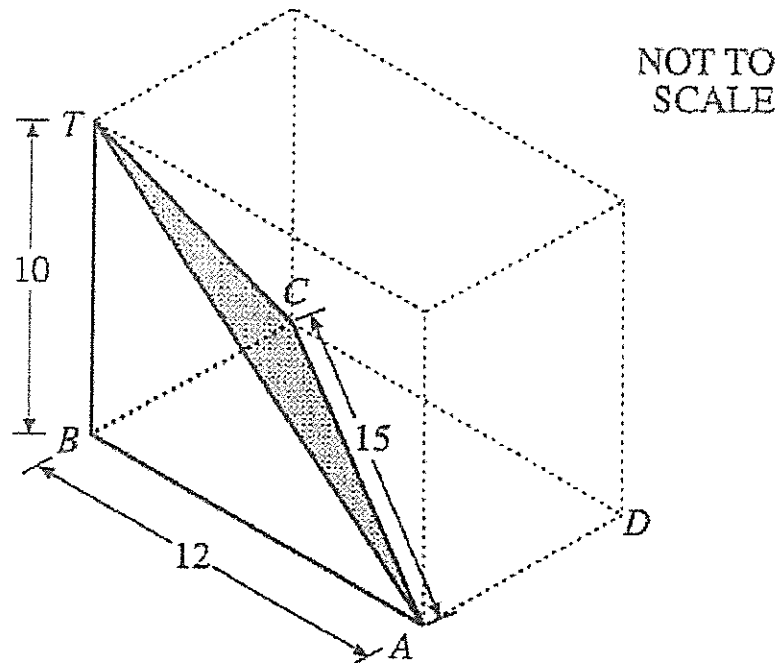
What percentage of the water is left in the pool?

(iv) When the circular wall was formed there was an overlap of the metal (1)

sheet. Calculate the length of overlap, correct to the nearest centimetre.

(c)

(2)



A rectangular prism has base $ABCD$.

The triangular pyramid $ABCT$ is to be cut from the rectangular prism, as indicated above.

All measurements are in centimetres.

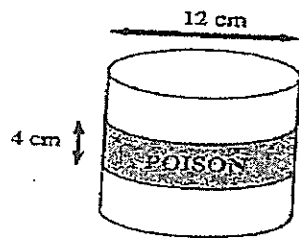
Find the volume of this pyramid.

- (d) Find the volume of a soccer ball of radius 12cm (round off to the nearest whole number)

(1)

(e)

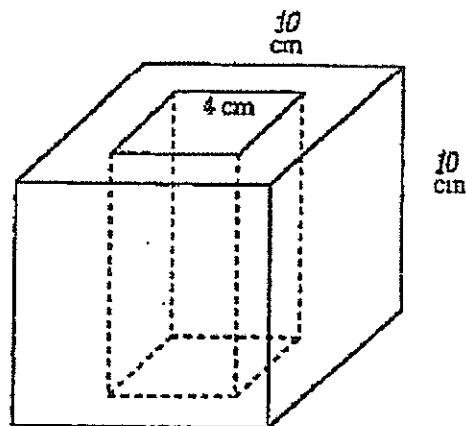
(1)



A label 4cm wide just fits around a cylinder with diameter 12cm. Calculate the area of the label in terms of π .

(f)

(2)



A 10cm cube has a 4cm square hole cut through it. Calculate the remaining volume.

PART B – STATISTICS

For this set of scores, find the mode and range.

(1)

Score	frequency
6	4
7	5
8	7
9	6
10	3

(b)

(1)

The following stem-and-leaf plot represents the results of a class project.

Boys		Girls
00	5	0
9864	4	24
875	3	347
6	2	67
8	1	24
	0	7

What is the difference between the medians for boys and girls?

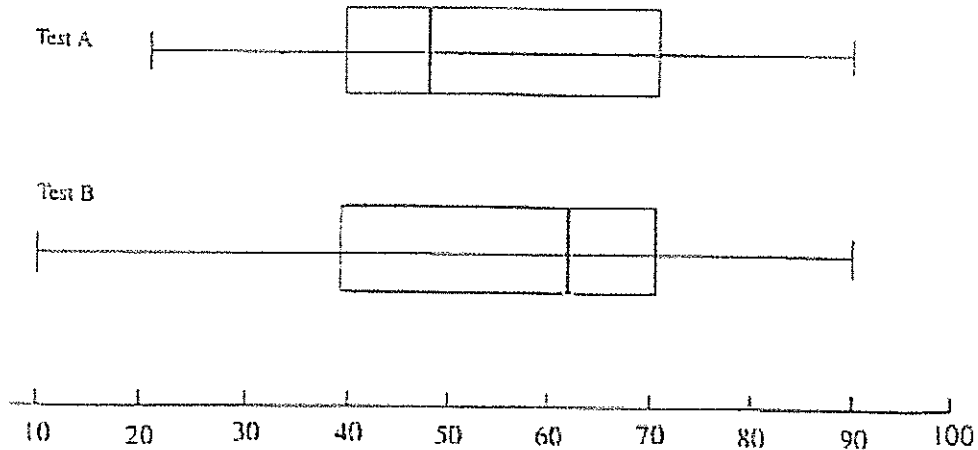
(c)

(2)

Find the value of x if the following set of scores has a mean of 6.

Score	Frequency
4	3
5	6
x	6

- (d) The box-and-whisker plots below show the results for a class on two Mathematics tests.



- (i) What was the interquartile range for Test B (1)

- (ii) The top half of the class performed better on Test B. How do the box and whisker plots show this? (2)

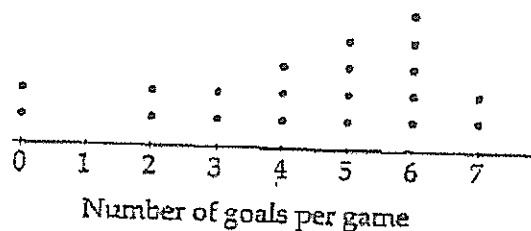
- (e) For the back – to – back stem and leaf plots below, the standard deviation for each set (left to right) is 11.1 and 13.7.

**Back-to-back
stem-and-leaf plots**

	12	3 7
0	11	0 2 6 6
8 4	10	1 4 4 7 9
9 7 4 4 4 3	9	3 6 6 8
6 6 5 5 1	8	2 5
7 4 0	7	3
Set A		Set B

- In one sentence, compare the two sets of data using the standard deviations. (1)

(f) The dot plot shows the number of goals per game scored by Stephen's team during a football competition.

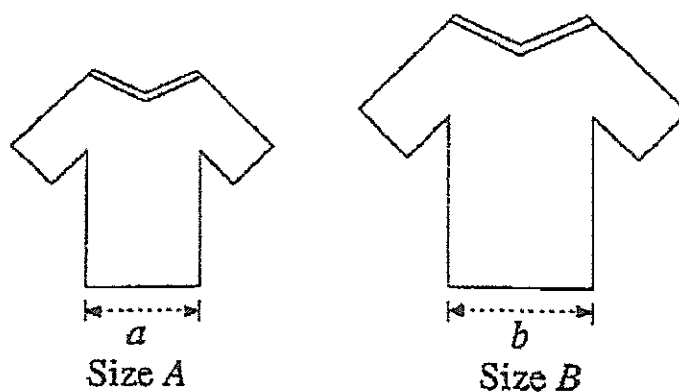


- (i) How many games did Stephen's team play? (1)
- (ii) What was the median number of goals scored per game? (1)
- (iii) What was the average number of goals scored per game, to one decimal place? (1)

PART C – SIMILARITY

- (a) The two T-shirts are similar shapes.

(1)

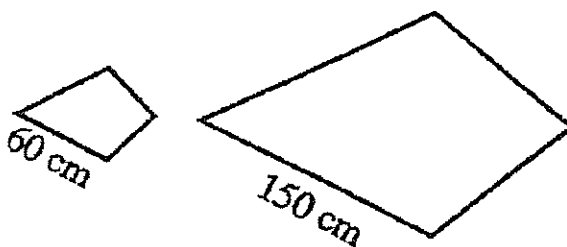


The ratio $a : b = 4 : 5$.

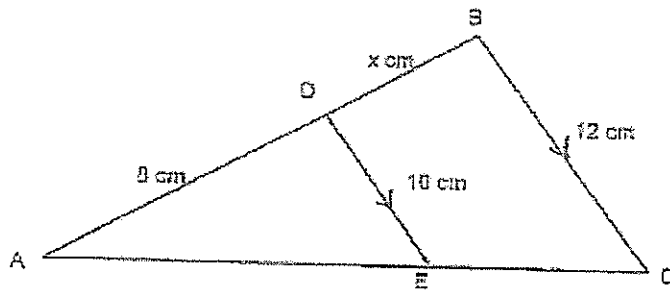
Write down the ratio of the area of material used in each T-shirt in the form

Area (Size A) : Area (Size B)

- (b) These two kites are similar. The area of the smaller kite is 0.2 m^2 . What is the area (1) of the larger kite?



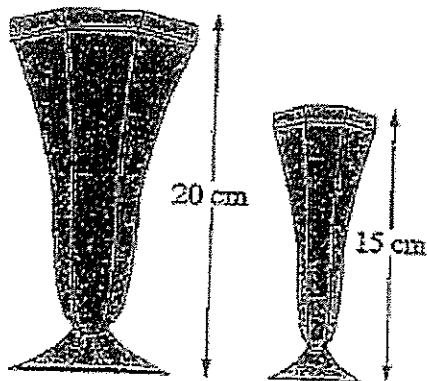
(c)



(i) Which test proves that $\triangle ADE \sim \triangle ABC$? (1)

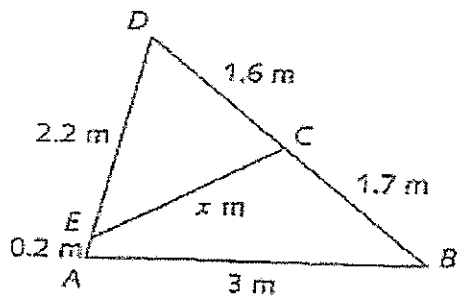
(ii) Find the value of x . (2)

(d) Two similar vases have heights 15cm and 20cm respectively. If the smaller vase has a volume of 135cm^3 , what is the volume of the larger vase? (2)



(e)

(2)



Given that $\triangle DEC$ is similar to $\triangle DBA$, find the value of x .

(f) By what factor must the radius of a spherical balloon be multiplied if the volume is to be increased from 760cm^3 to 389120cm^3 ?

(2)

PART D – NUMBER PLANE GRAPHS

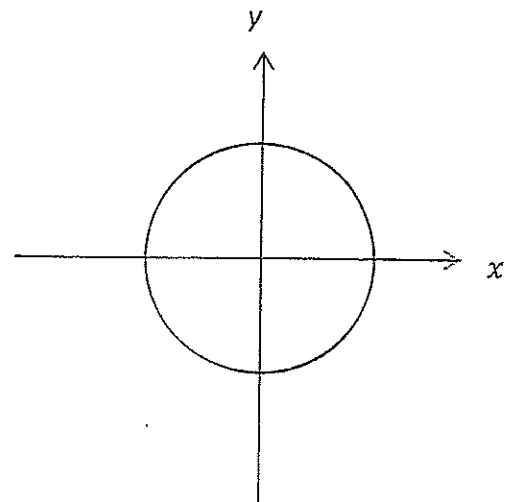
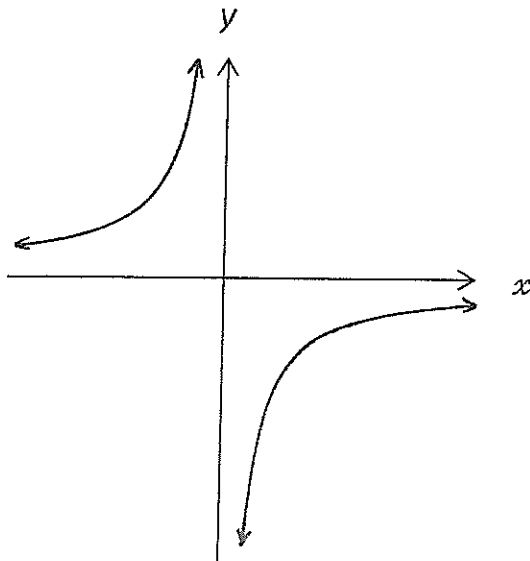
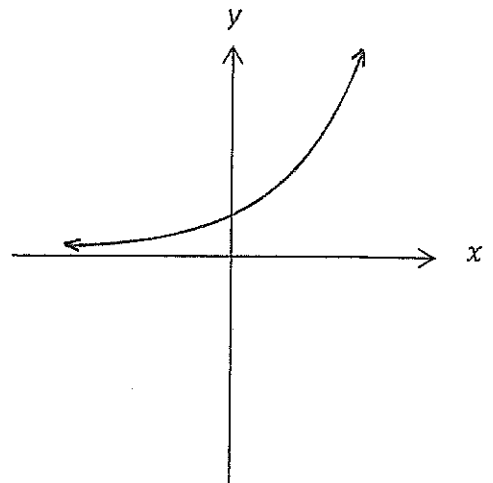
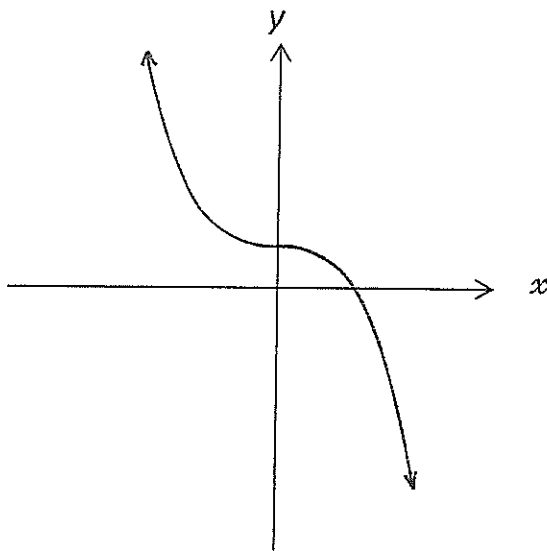
(a) For the following 4 equations, write the corresponding letter next to each graph. (1)

(A) $x^2 + y^2 = 9$

(B) $xy = -4$

(C) $y = 2^x$

(D) $y = -x^3 + 1$



- (b) The hyperbola $y = \frac{k}{x}$ passes through the point (4,-8). (1)

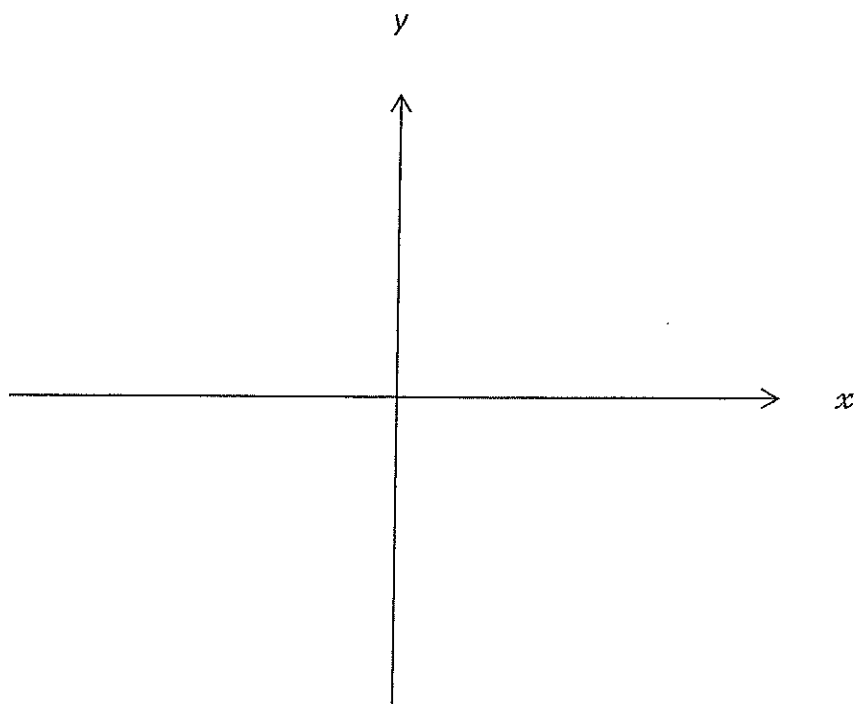
Find the value of k.

- (c) Give the equation of the asymptote on the curve $y = 3^x$. (1)

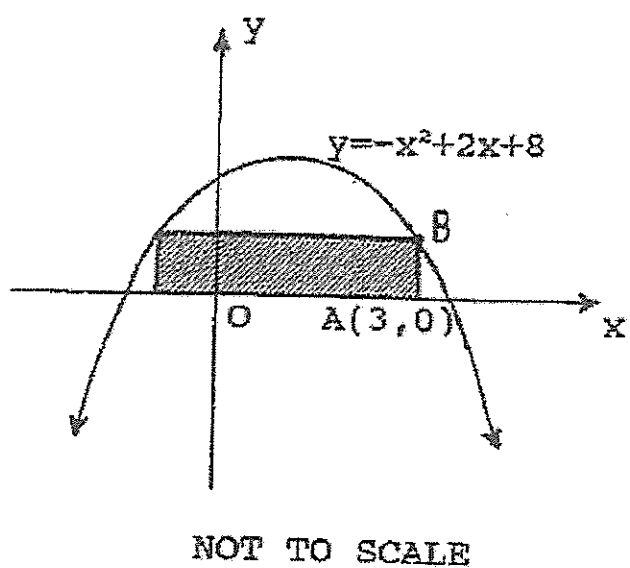
- (d) What is the radius of the circle $4x^2 + 4y^2 = 16$? (1)

- (e) Find the equation of the circle with centre at the origin that passes through the point (-2,3). Leave in exact form. (2)

- (f) Sketch $y = 2x^3$ and $y = x^3$ on the number plane below labelling a point other than the origin on each graph. (2)



(g)



A is the point with coordinates (3, 0).

(i) Find the y coordinate of B (1)

(i) Hence find the area of the shaded rectangle. (2)

PART E – MISCELLANEOUS

(a)

(1)

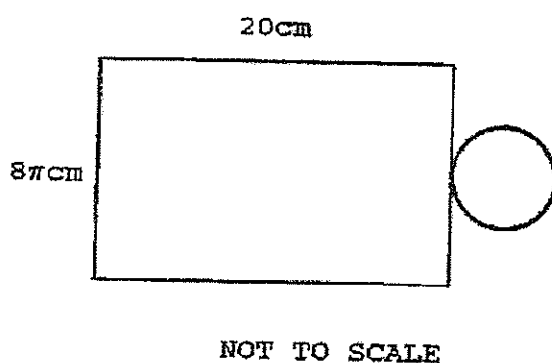
The following statistics were obtained from Year 10 English and Science tests:

SUBJECT	MEAN	STANDARD DEVIATION
English	60	6
Science	70	8

What mark in Science would be equivalent to a mark of 66 in English?

(b)

(2)

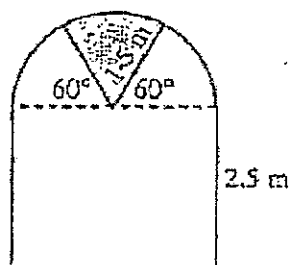


When folded, this net makes an open cylinder.

Find the volume of the cylinder correct to the nearest whole number.

(c)

(2)

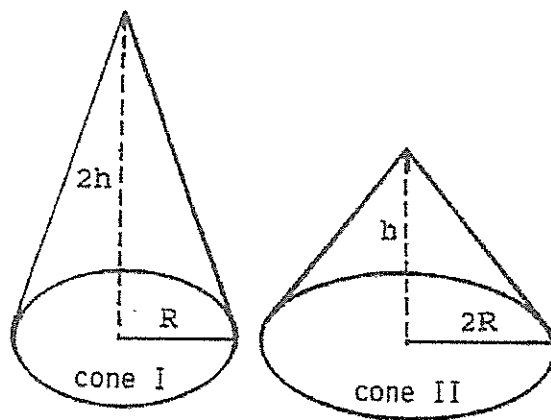


A small part of this window is shaded. The radius of the semi circular section is 1.5 m.

Find the area of the unshaded section correct to one decimal place.

(d)

(2)



NOT TO SCALE

Ratio of radii $1:2$

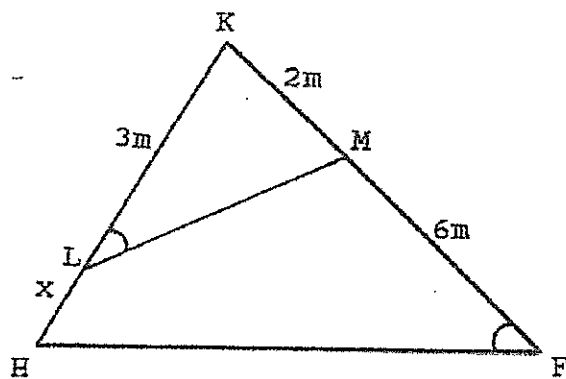
Ratio of height $2:1$

The volume of cone I is 50m^3

Find the volume of cone II.

(e)

(2)



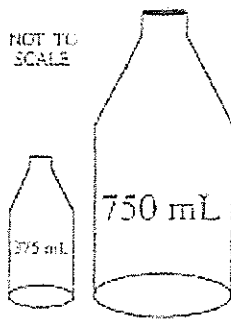
NOT TO SCALE

Triangle KML is similar to triangle KHF .

Find the value of x .

(f)

(2)



These soft drink bottles are similar.

The larger bottle has twice the volume of the smaller bottle.

Find the ratio of the *heights* (larger to smaller) of the bottles correct to 2 decimal places.

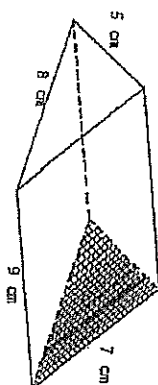
END OF PAPER

SECTION 2 : SHORT ANSWER QUESTIONS

Show your working and write your answers in the space provided. Marks are indicated next to each question.

PART A – SURFACE AREA and VOLUME

(a)

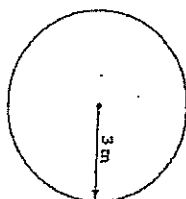


The area of the shaded end of this triangular prism is 17.5 cm^2 . Find the total surface area of the prism.

(1)

$$SA = 2 \times 17.5 + 63 + 72 + 45 = 215 \text{ cm}^2$$

(b) (i)

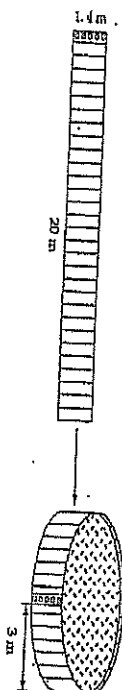


The base of a swimming pool is a circle of radius 3 metres. Find its area correct to two decimal places.

(1)

$$A = \pi \times 3^2 = 28.27 \text{ m}^2$$

The flexible metal sheet drawn below is used to form the wall of the pool



(ii) Find the volume of the pool, correct to the nearest cubic metre.

(1)

$$V = \pi r^2 h = \pi \times 3^2 \times 1.4 = 40 \text{ m}^3$$

(iii)

Before a party, the pool is filled with water. After the party, the depth has dropped to 98 centimetres. (1)

What percentage of the water is left in the pool?

$$\frac{98}{140} \times \frac{100}{1} = 70\%$$

(iv)

When the circular wall was formed there was an overlap of the metal sheet. Calculate the length of overlap, correct to the nearest centimetre. (1)

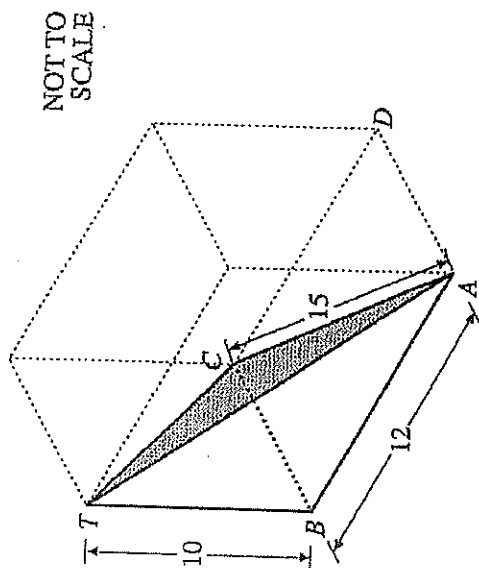
$$C = 2 \times \pi \times 3 = 18.85 \text{ m}$$

$$\therefore \text{Overlap} = 20 - 18.85$$

$$= 1.15 \text{ m or } 115 \text{ cm}$$

(c)

(2)



A rectangular prism has base ABCD.

The triangular pyramid $ABCT$ is to be cut from the rectangular prism, as indicated above.

All measurements are in centimetres.

Find the volume of this pyramid.

$$\begin{aligned}
 V &= \frac{1}{3} \times A_{\text{base}} \times h \\
 &= \frac{1}{3} \times \left(\frac{1}{2} \times 9 \times 12 \right) \times 10 \\
 &= 180 \text{ cm}^3
 \end{aligned}$$

(d) Find the volume of a soccer ball of radius 12cm (round off to the nearest whole number)

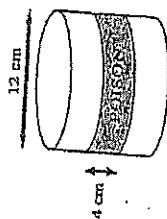
(1)

$$\begin{aligned}
 V &= \frac{4}{3} \pi r^3 \\
 &= \frac{4}{3} \pi \times 12^3 \\
 &= 7238 \text{ cm}^3
 \end{aligned}$$

(e)

(1)

A label 4cm wide just fits around a cylinder with diameter 12cm. Calculate the area of the label in terms of π .

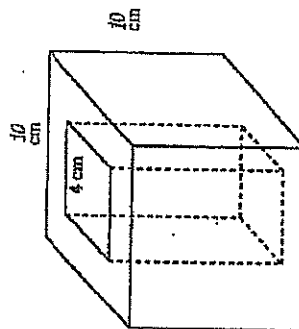


$$\begin{aligned}
 A &= 2\pi rh \\
 &= 2\pi \times 6 \times 4 \\
 &= 48\pi \text{ cm}^2
 \end{aligned}$$

(f)

(2)

A 10cm cube has a 4cm square hole cut through it. Calculate the remaining volume.



$$\begin{aligned}
 V &= 10^3 - 4^2 \times 10 \\
 &= 1000 - 160 \\
 &= 840 \text{ cm}^3
 \end{aligned}$$

PART B – STATISTICS

(a) For this set of scores, find the mode and range.

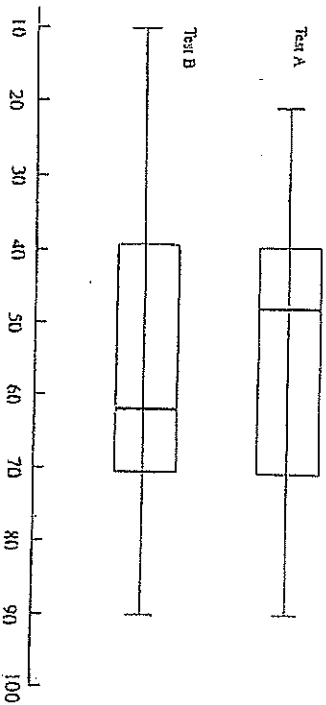
Score	frequency
6	4
7	5
8	7
9	6
10	3

Mode is 8

Range is 4

(1)

(d) The box-and-whisker plots below show the results for a class on two Mathematics tests.



(i) What was the interquartile range for Test B

$$70 - 39 = 31 \text{ (accept 32 or 30)}$$

(1)

(ii) The top half of the class performed better on Test B. How do the box and whisker plots show this?

(2)

62 compared to 48 in Test A

For the back – to – back stem and leaf plots below, the standard deviation for each set (left to right) is 11.1 and 13.7.

Boys		Girls	
00	5	0	0
9864	4	24	
875	3	347	
6	2	67	
8	1	24	
	0	7	

6th score is 33

What is the difference between the medians for boys and girls?

$$\text{Difference} = 44 - 33 = 11$$

(c)

Find the value of x if the following set of scores has a mean of 6.

Score	Frequency
4	3
5	6
x	6

$$6 = \frac{6x + 42}{15}$$

$$90 = 6x + 42$$

$$6x = 48$$

$$x = 8$$

(2)

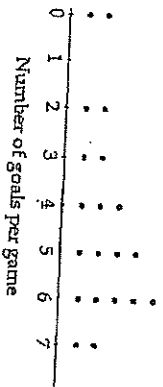
Back-to-back stem-and-leaf plots

Set A	Set B
974443	9
66551	8
740	7
	3

In one sentence, compare the two sets of data using the standard deviations. (1)

Set A's scores are less scattered or more clustered due to lower standard deviation.

(f) The dot plot shows the number of goals per game scored by Stephen's team during a football competition.



(i) How many games did Stephen's team play?

(1)

20

(ii) What was the median number of goals scored per game?

(1)

5

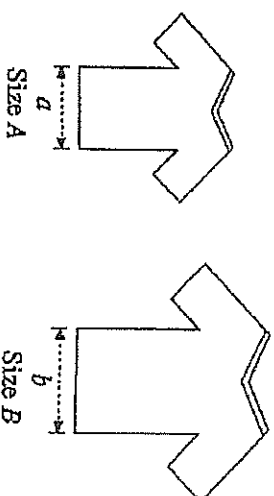
(iii) What was the average number of goals scored per game, to one decimal place? (1)

$$\bar{x} = \frac{2 \times 1 + 3 \times 2 + 4 \times 3 + 5 \times 4 + 6 \times 3 + 7 \times 2}{20} = 4.3 \text{ goals/game}$$

PART C – SIMILARITY

(a) The two T-shirts are similar shapes.

(1)



The ratio $a : b = 4 : 5$.

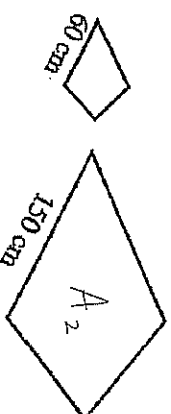
Write down the ratio of the area of material used in each T-shirt in the form

Area (Size A) : Area (Size B)

$$4^2 : 5^2$$

$$16 : 25$$

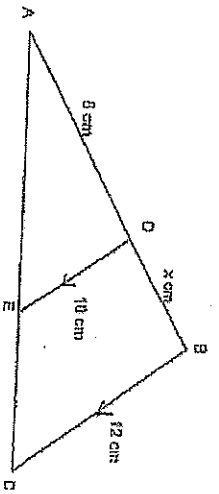
(b) These two kites are similar. The area of the smaller kite is 0.2 m^2 . What is the area (1) of the larger kite?



$$\frac{A_2}{0.2} = \left(\frac{150}{60}\right)^2$$

$$A_{\text{larger}} = 1.25 \text{ m}^2$$

(c)

(i) Which test proves that $\triangle ADE \sim \triangle ABC$?

Equivalent (not AAA)

(1)

(ii) Find the value of x .

$$\frac{8}{8+x} = \frac{10}{12}$$

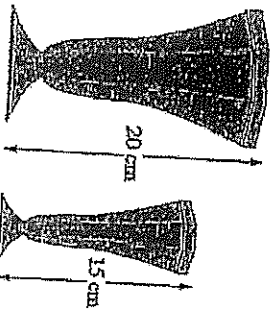
$$96 = 80 + 10x$$

$$x = 1.6$$

(2)

(d) Two similar vases have heights 15 cm and 20 cm respectively. If the smaller vase has a volume of 135 cm^3 , what is the volume of the larger vase?

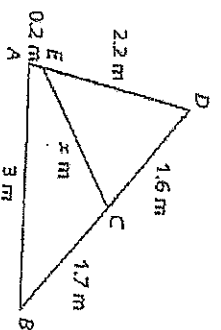
(2)



$$\frac{V_{\text{larger}}}{135} = \left(\frac{20}{15}\right)^3$$

$$V_{\text{larger}} = 320 \text{ cm}^3$$

(e)

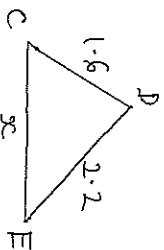


Given that $\triangle DEC$ is similar to $\triangle DBA$, find the value of x .

$$\frac{x}{3} = \frac{1.6}{2.4}$$

$$x = 2 \text{ m}$$

(2)



(f) By what factor must the radius of a spherical balloon be multiplied if the volume

is to be increased from 760 cm^3 to 389120 cm^3 ?

(2)

$$\left(\frac{r_2}{r_1}\right)^3 = \frac{389120}{760}$$

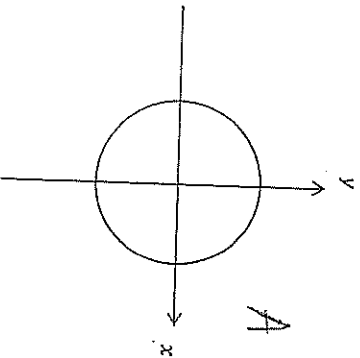
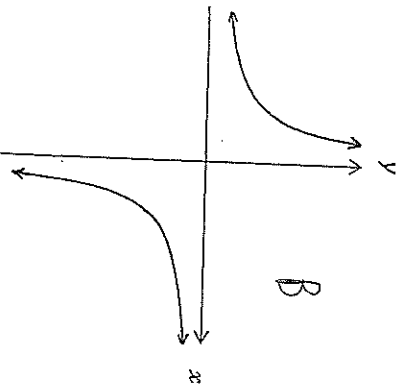
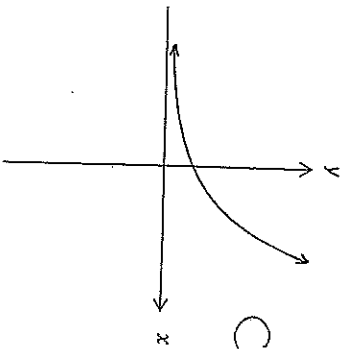
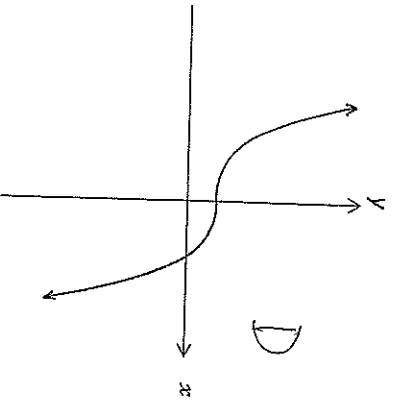
$$\frac{r_2}{r_1} = \sqrt[3]{\frac{389120}{760}}$$

$$= 8$$

PART D – NUMBER PLANE GRAPHS

- (a) For the following 4 equations, write the corresponding letter next to each graph. (1)

- (A) $x^2 + y^2 = 9$
 (B) $xy = -4$
 (C) $y = 2^x$
 (D) $y = -x^3 + 1$



- (b) The hyperbola $y = \frac{k}{x}$ passes through the point (4, 8). (1)

Find the value of k. $-8 = \frac{k}{4}$

$k = -32$

- (c) Give the equation of the asymptote on the curve $y = 3^x$. (1)

$y = 0$

- (d) What is the radius of the circle $4x^2 + 4y^2 = 16$? (1)

$x^2 + y^2 = 4$

radius = 2

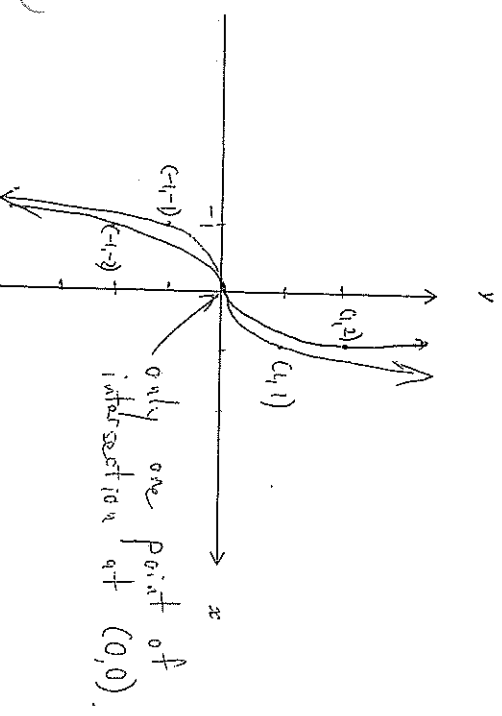
- (e) Find the equation of the circle with centre at the origin that passes through the

point (-2, 3). Leave in exact form.

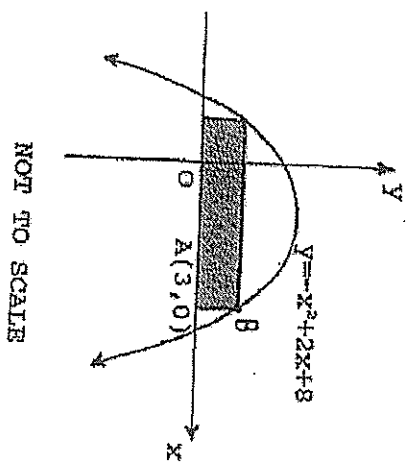
(2)

$x^2 + y^2 = r^2$
 $(-2)^2 + (3)^2 = r^2$
 $r^2 = 13$
 $r = \sqrt{13}$

- (f) Sketch $y = 2x^3$ and $y = x^3$ on the number plane below labelling a point other than the origin on each graph. (2)



(8)



A is the point with coordinates (3, 0).

→ (i)

Find the y coordinate of B

$$y = -(3)^2 + 2(3) + 8$$

$$= -9 + 6 + 8$$

$$= 5$$

(1)

ii (ii)

Hence find the area of the shaded rectangle.

$$5 = -x^2 + 2x + 8$$

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

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

$$x = -1$$

$$\text{Area} = 4 \times 5 = 20 \text{ units}^2$$

(2)

PART E – MISCELLANEOUS

(a)

The following statistics were obtained from Year 10 English and Science tests:

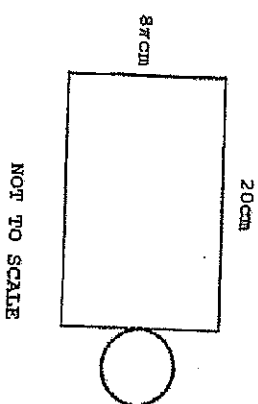
SUBJECT	MEAN	STANDARD DEVIATION
English	60	6
Science	70	8

What mark in Science would be equivalent to a mark of 66 in English?

$$70 + 8 = 78$$

(1)

(b)



When folded, this net makes an open cylinder.

Find the volume of the cylinder correct to the nearest whole number.

$$r = 4$$

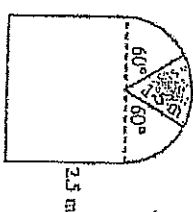
$$V = \pi r^2 h$$

$$= \pi \times 4^2 \times 20$$

$$= 1005 \text{ cm}^3$$

(2)

(c)



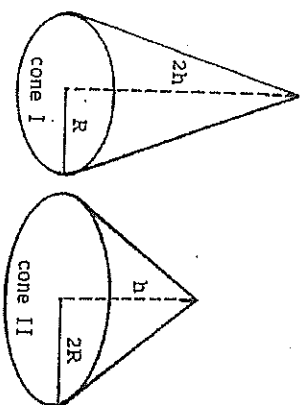
A small part of this window is shaded. The radius of the semi circular section is 1.5m.

Find the area of the unshaded section correct to one decimal place.

$$A = 2.5 \times 3 + \frac{1}{2} \times \pi \times 1.5^2$$

$$= 9.9 \text{ m}^2$$

(d)



Ratio of radii 1:2
Ratio of height 2:1

The volume of cone I is 50 m^3
Find the volume of cone II.

$$\frac{1}{3} \pi R^2 \times 2h : \frac{1}{3} \pi (2R)^2 \times h$$

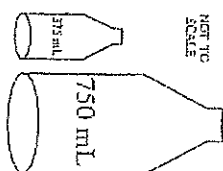
$$2R^2h : 4R^2h$$

$$1 : 2$$

$$V_{\text{cone II}} = 100\text{ m}^3$$

(2)

(f)



These soft drink bottles are similar.

The larger bottle has twice the volume of the smaller bottle.

Find the ratio of the heights (larger to smaller) of the bottles correct to 2 decimal places.

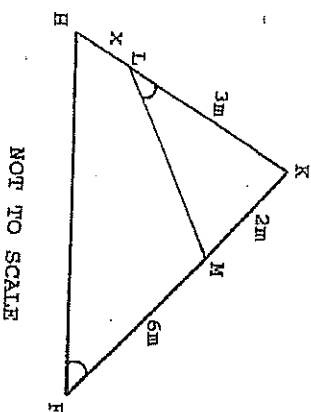
$$\left(\frac{h_L}{h_S} \right)^3 = \frac{750}{375}$$

$$\frac{h_L}{h_S} = \sqrt[3]{\frac{750}{375}}$$

$$= 1.26$$

(2)

(e)



Triangle KML is similar to triangle KHF.

Find the value of x .

$$\frac{3+x}{2} = \frac{3}{8}$$

$$6 = 24 + 8x$$

$$8x = 18$$

$$x = 2.25^\circ$$

(2)

END OF PAPER

Name: _____

Teacher: _____

please use
Maths Faculty
M-C sheet

SECTION A: MULTIPLE CHOICE

Instructions:

- Circle the letter that best answers the question
- One mark each

- | | | | | |
|-----|----------------------------------|----------------------------------|----------------------------------|----------------------------------|
| 1. | A | B | <input checked="" type="radio"/> | D |
| 2. | A | <input checked="" type="radio"/> | C | D |
| 3. | A | B | C | <input checked="" type="radio"/> |
| 4. | A | B | <input checked="" type="radio"/> | D |
| 5. | A | <input checked="" type="radio"/> | C | D |
| 6. | A | B | <input checked="" type="radio"/> | D |
| 7. | A | B | C | <input checked="" type="radio"/> |
| 8. | <input checked="" type="radio"/> | B | C | D |
| 9. | A | <input checked="" type="radio"/> | C | D |
| 10. | A | <input checked="" type="radio"/> | C | D |