Name: ..... Maths Class: .....

SYDNEY TECHNICAL HIGH SCHOOL

Year 10
Mathematics Yearly

Examination

2015

Time allowed: 2 hours

General Instructions:

- Marks for each question are indicated on the question.
- Approved calculators may be used
- All necessary working should be shown
- Full marks may not be awarded for careless work or illegible writing
- ***Begin each question on a new page***
- Write using black or blue pen
- All answers are to be in the writing booklet provided

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Section 1 Multiple Choice
Questions 1-25
20 Marks

- Attempt Questions 1 - 25
- Allow about 40 minutes for this section
- Answer on the Multiple choice answer sheet provided

Section II Questions 26-30
50 Marks

- Attempt questions 21 to 25
- Allow about 80 minutes for this section

Section I

25 marks
Attempt Questions 1–25
Allow about 40 minutes for this section

Use the multiple-choice answer sheet for Questions 1–25.

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1. Expand and simplify $2x^2 + 3xy - 2x(x - 4y)$.

   (A) $11xy$

   (B) $4x^2 - 5xy$

   (C) $-4x^2 - 11xy$

   (D) $-11xy$

2. If $U = a^3 + bc^2$, find U when $a = 2$, $b = -1$ and $c = 2$.

   (A) $U = 9$

   (B) $U = 2$

   (C) $U = 12$

   (D) $U = 4$

3. The solution to $2x + 9 = 5x - 12$ is:

   (A) $x = -1$

   (B) $x = 7$

   (C) $x = 3$

   (D) $x = \frac{3}{7}$

4. Roger works for a fast food outlet where he is paid \$14.00 per hour for up to 8 hours per day and time and a half after that. What would he earn for a day where he works for 12 hours?

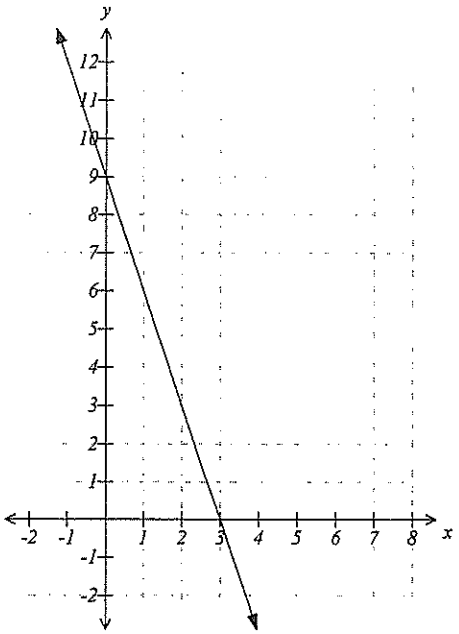
(A) \$168.00

(B) \$196.00

(C) \$252.00

(D) \$224.00

5. The line shown at right has gradient:



(A) 9

(B) 3

(C) -3

(D) $-\frac{1}{3}$

6. Kerrie has a taxable income of \$45 200. The Medicare levy is calculated as 1.5% of taxable income. What is her Medicare levy?

(A) \$2 260.00

(B) \$6 780.00

(C) \$301.33

(D) \$678.00

7. Lasseter invests his lottery win of $20 000 in a term deposit which pays 9% p.a. compounded monthly. What will the investment be worth after the term of 2 years?

(A) $20 301
(B) $23 600
(C) $23 928
(D) $23 762

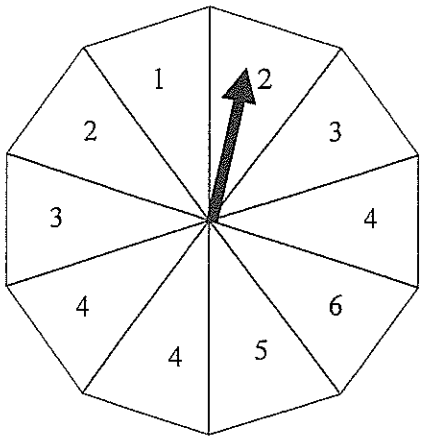
8. Marika buys a camera for $308.00 including GST. She can claim the GST back, as she is travelling overseas. How much is the GST? (Assume GST is 10%)

(A) $28.00
(B) $30.80
(C) $280.00
(D) $20.00

9. When a single card is drawn from a normal pack of 52 cards, what is the probability that it is not an Ace?

(A) $\frac{1}{13}$
(B) $\frac{12}{13}$
(C) $\frac{1}{4}$
(D) $\frac{3}{4}$

10. The spinner below is used to determine the number of squares moved in a game. What is the probability that, on a single spin, the outcome is a number greater than 4?



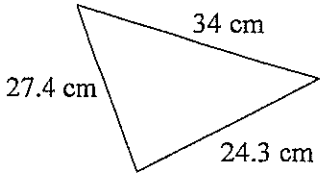
(A) $\frac{1}{5}$

(B) $\frac{1}{2}$

(C) $\frac{4}{5}$

(D) $\frac{1}{10}$

11. The smallest angle in the triangle below is θ



What is the value of θ to the nearest degree?

(A) 30°

(B) 45°

(C) 53°

(D) 82°

12. A glass has its capacity measured as 250 mL to the nearest 10 mL. What is the percentage error in this measurement?

(A) ± 10%

(B) ±0.2%

(C) ±4%

(D) ±2%

13. The ratio of sand : cement in a mortar mix is 9 : 2. How many buckets of sand would be needed to go with 12 buckets of cement?

(A) $1\frac{1}{2}$ buckets.

(B) $14\frac{2}{3}$ buckets.

(C) $2\frac{2}{3}$ buckets.

(D) 54 buckets.

14. A car travels from Bourke to Dubbo at an average speed of 96 km/h. Write this as an average speed in m/s.

(A) 16 m/s.

(B) $345\frac{3}{5}$ m/s.

(C) $26\frac{2}{3}$ m/s.

(D) $66\frac{2}{3}$ m/s.

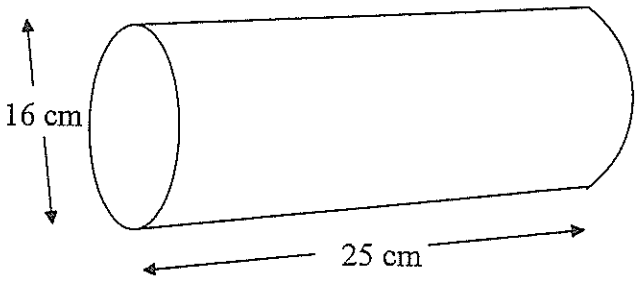
15. Find the volume of the cylinder shown below.

(A) 20 106 cm^3

(B) 5 027 cm^3

(C) 1 257 cm^3

(D) 1 659 cm^3



16. Figure A and Figure B, shown below, are similar. What is the scale factor which would transform Figure A to Figure B?

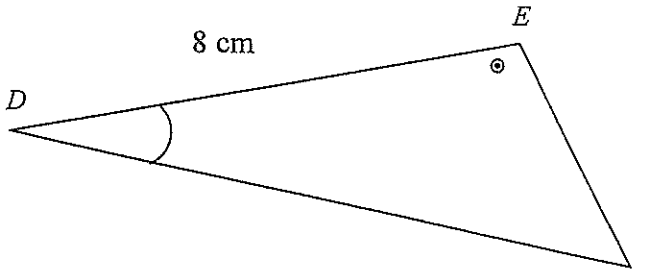


Figure A

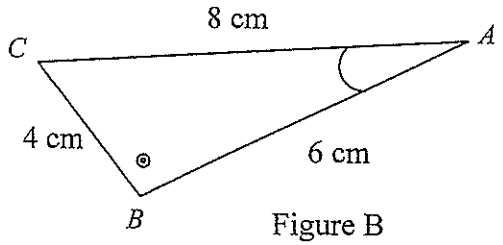


Figure B

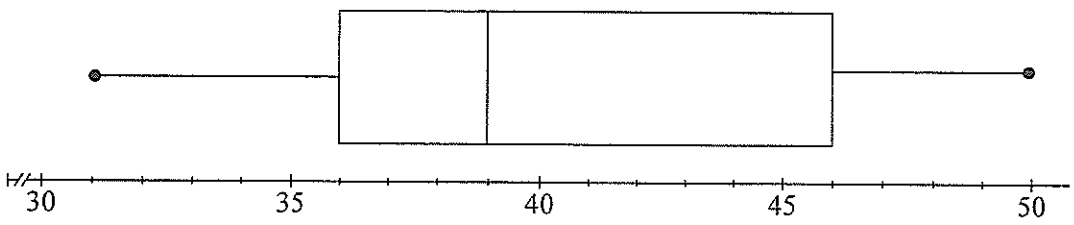
(A) $\frac{3}{4}$

(B) $\frac{4}{3}$

(C) 2

(D) $\frac{1}{2}$

17. The box and whisker plot shows the results of a test out of 50 (fifty). What information **cannot** be found from the plot?



(A) The median mark.

(B) The interquartile range of the marks.

(C) The range of the marks.

(D) The mean mark.

18. The stem and leaf plot gives the ages of a group of people at a function. What is the median age?

(A) 37.5
(B) 37
(C) 38
(D) 41

2	3 4 6 6 7
3	0 2 4 5 7 8 9
4	1 2 4 6 8
5	2 5 6
6	0

19. A formula for finding the sum (S) of the angles in a regular polygon is:

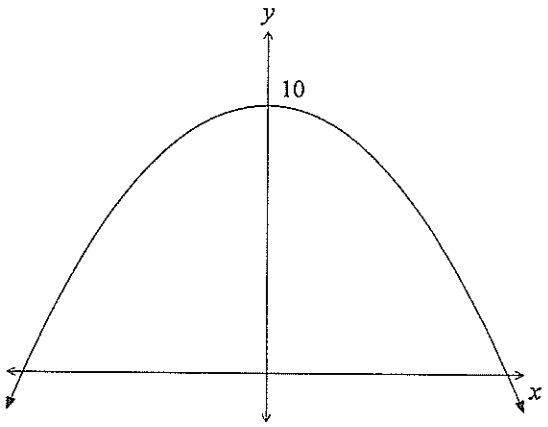
$$S = (2n-4) \times 90^\circ,$$

where n is the number of sides in the figure. Which of the following formulae could give the same result?

(A) $S = (n-2) \times 45^\circ$
(B) $S = 4(n-2) \times 90^\circ$
(C) $S = (n-2) \times 180^\circ$
(D) $S = 4(n-8) \times 180^\circ$

20. Which equation could describe the graph shown?

(A) $y = x^2 + 10$
(B) $y = 2x + 10$
(C) $y = 10 - x^2$
(D) $y = 10 - 2x$



21. What is the centre and radius of the circle with the equation $x^2+y^2+6x-8y-11=0$?

(A) Centre $(-3,-4)$ and radius 36

(B) Centre $(-3,4)$ and radius 36

(C) Centre $(-3,-4)$ and radius 6

(D) Centre $(-3,4)$ and radius 6

22. What is the midpoint of $(-3,5)$ and $(2,-3)$?

(A) $(-\frac{1}{2},1)$

(B) $(\frac{1}{2},-1)$

(C) $(0,\ 1)$

(D) $(2\frac{1}{2},4)$

23. The line $6x-ky=2$ passes through the point $(3,2)$. What is the value of k?

(A) $\frac{10}{3}$ (B) $-\frac{10}{3}$

(C) -8 (D) 8

24. What is the solution to the quadratic equation $x^2-5x+3=0$?

(A) $x=\frac{-5\pm\sqrt{13}}{2}$

(B) $x=\frac{-5\pm\sqrt{38}}{2}$

(C) $x=\frac{5\pm\sqrt{13}}{2}$

(D) $x=\frac{5\pm\sqrt{38}}{2}$

25. The sum of the interior angles of a regular polygon is 2520°. What is the size of each interior angle?

(A) 140°30'

(B) 157°30'

(C) 210°

(D) 315°

Section II

50 Marks

Attempt all questions 25 to 30

Allow about 80 minutes for this section

Answer all questions, starting each question on a new sheet of paper in your answer booklet, with the question number at the top of the page. Your responses should include relevant mathematical reasoning and/or calculations.

Question 26 **(10 marks)**

Start a new sheet of paper.

a) Round 183 479 208 to 3 significant figures 1

b) Solve the equation $\frac{2x}{3} + 5 = x + 2$. 1

c) Write the formula $g = \frac{sm}{2} + a$ with m as the subject. 1

d) Factorise $4a - 2b - 6ab + 3b^2$ 1

e) Write the following as powers of 2:

(i) $\sqrt[5]{2}$ (ii) $\sqrt[3]{32}$ (iii) $\frac{1}{\sqrt[5]{64}}$ 3

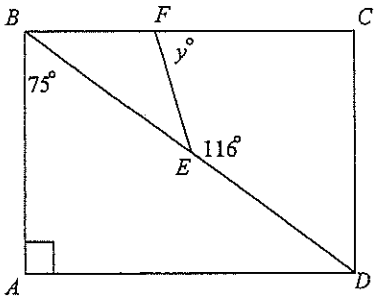
f) The probability of tossing a head on a biased coin is 0.7.
What is the probability of tossing a tail on this coin? 1

g) Given $x = \sqrt{5} + 2$, find b if $x + \frac{1}{x} = 2\sqrt{b}$ 2

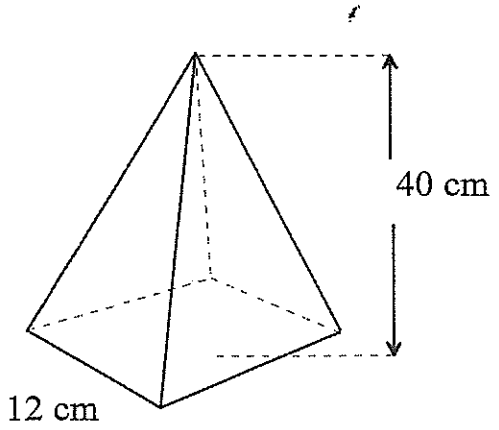
Question 27 **(10 marks)**

Start a new sheet of paper.

a) $ABCD$ is a rectangle. The value of y is: 1



b) A square pyramid is shown below.



(i) Find the volume of the pyramid. 1

(ii) The height of the pyramid is increased by 20%, while the base is left unchanged. Calculate the new volume. 1

(iii) What is the percentage increase in the volume of the pyramid when this change is made? 2

c) Using the table below or otherwise, answer the following questions.

The table below shows the rate of return on \$1,000 when invested at the compound interest rate shown.

Term (Years)	Compound Interest Rate(p.a.)						
	5.0%	5.5%	6.0%	6.5%	7.0%	7.5%	8.0%
1	\$1,050.00	\$1,055.00	\$1,060.00	\$1,065.00	\$1,070.00	\$1,075.00	\$1,080.00
2	\$1,102.50	\$1,113.03	\$1,123.60	\$1,134.23	\$1,144.90	\$1,155.63	\$1,166.40
3	\$1,157.63	\$1,174.24	\$1,191.02	\$1,207.95	\$1,225.04	\$1,242.30	\$1,259.71
4	\$1,215.51	\$1,238.82	\$1,262.48	\$1,286.47	\$1,310.80	\$1,335.47	\$1,360.49
5	\$1,276.28	\$1,306.96	\$1,338.23	\$1,370.09	\$1,402.55	\$1,435.63	\$1,469.33
6	\$1,340.10	\$1,378.84	\$1,418.52	\$1,459.14	\$1,500.73	\$1,543.30	\$1,586.87
7	\$1,407.10	\$1,454.68	\$1,503.63	\$1,553.99	\$1,605.78	\$1,659.05	\$1,713.82
8	\$1,477.46	\$1,534.69	\$1,593.85	\$1,655.00	\$1,718.19	\$1,783.48	\$1,850.93
9	\$1,551.33	\$1,619.09	\$1,689.48	\$1,762.57	\$1,838.46	\$1,917.24	\$1,999.00

(i) What would be the value of an investment of \$2 500, invested at 5.5% p.a. compound interest after 4 years? 1

(ii) For what term would \$10 000 need to be invested at 6% p.a. compound interest, to grow to at least \$15 000? 1

(iii) Calculate the principal (to the nearest \$ 1 000) which would need to be invested at 8% p.a. compound interest for 8 years, to grow to \$61 000. 1

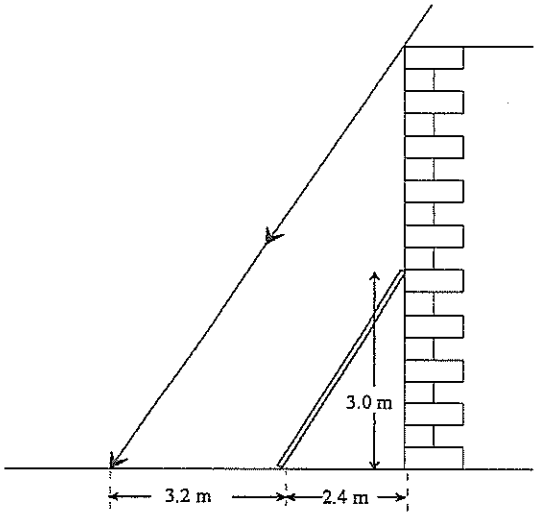
d) The angle of depression of a ship at sea from a cliff due west of the ship is 23°. The ship sails 100m due east and the angle of depression is 12°.

Find the height of the cliff 2

Question 28 (10 marks)

Start a new sheet of paper

a) Liam leans a pole against a wall at the same angle as the sun's rays at a given time, and takes the measurements shown below.
Calculate the height of the wall to the nearest metre. **2**



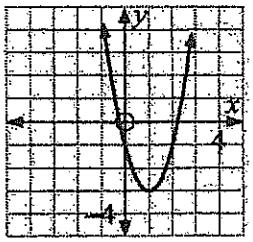
b) Given $y = x^2 + 7x - 5$, find the values(s) of x such that $y = 25$ **2**

c) Match each quadratic function with its corresponding graph: **4**

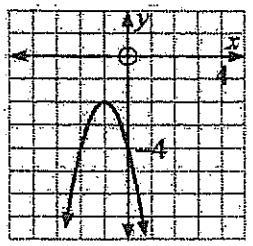
a $y = -(x-1)^2 + 2$ **b** $y = 2(x-1)^2 - 3$

c $y = -2(x+1)^2 - 2$ **d** $y = (x+1)^2 + 3$

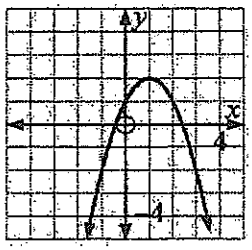
A



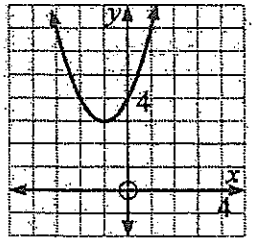
B



C



D

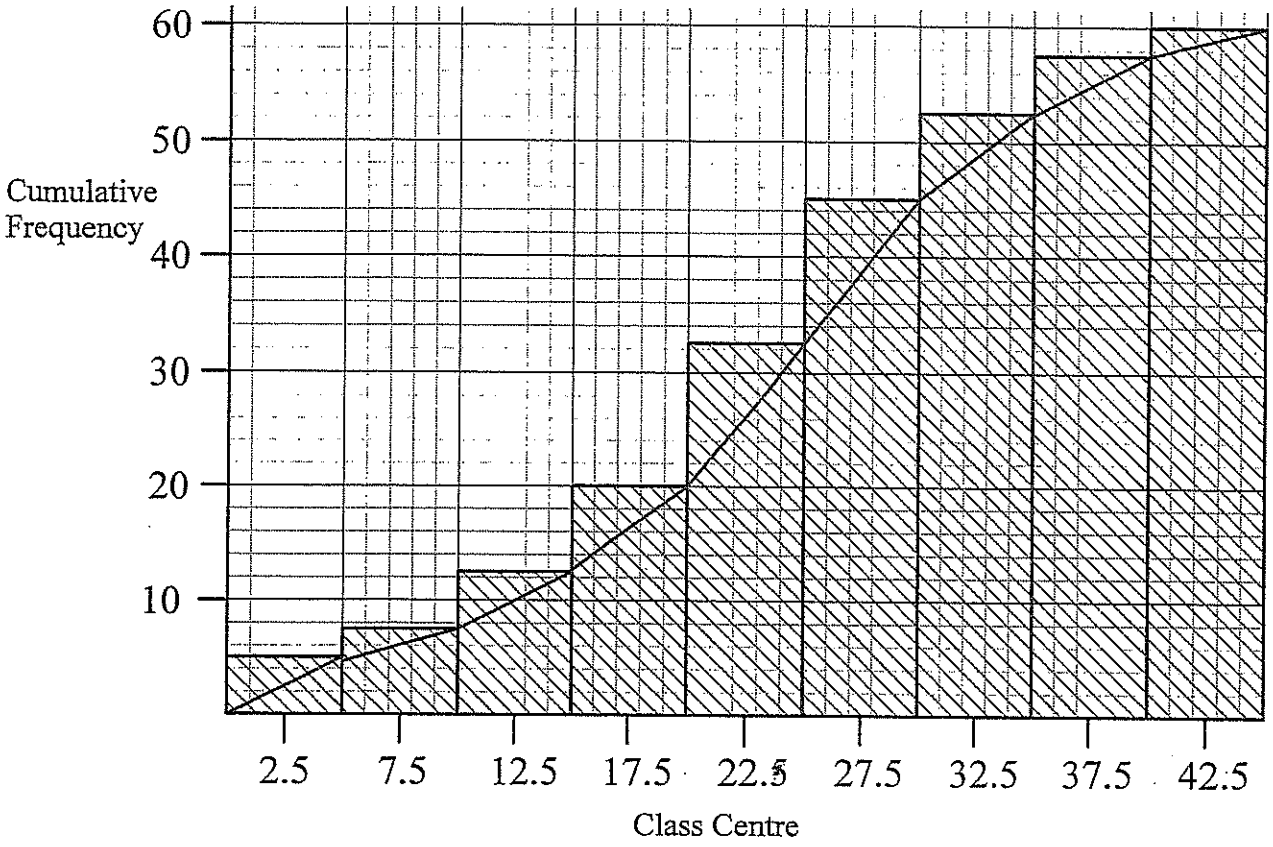


d) If θ is an acute angle and $\cos\theta = \frac{7}{11}$, without using a calculator, find the exact values of $\sin\theta$ and $\cot\theta$ **2**

Question 29 **(10 marks)**

Start a new sheet of paper

a) A cumulative frequency histogram and polygon are shown below.



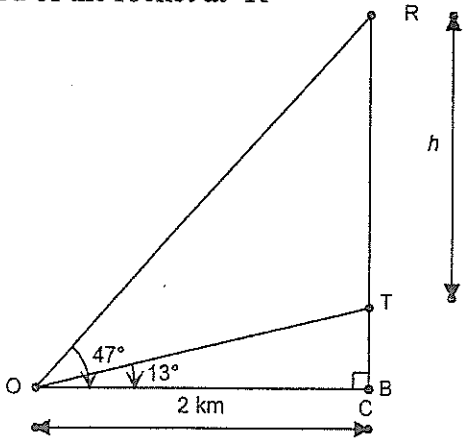
(i) Estimate the median of the data. **1**

(ii) Estimate the interquartile range of the data. **2**

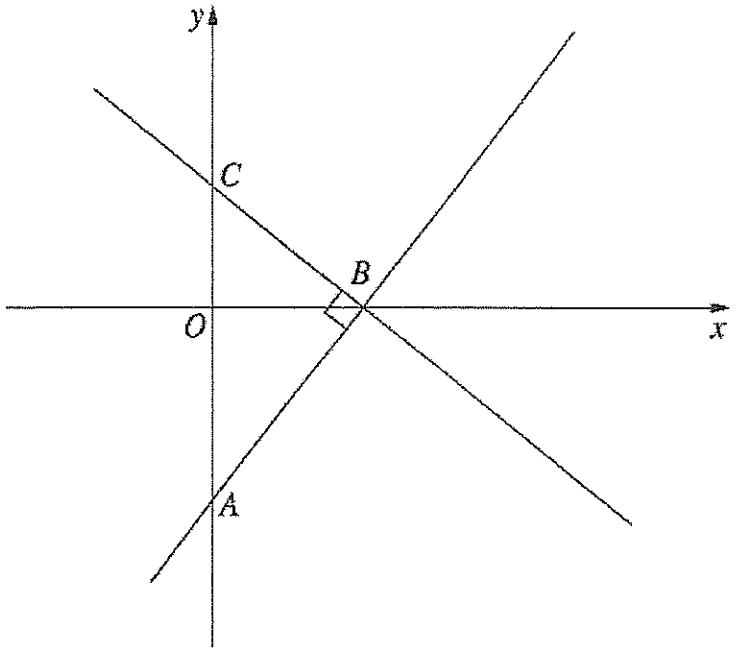
b) A rocket is launched from the top of a tower (point T), and is observed a distance of 2km away, at point O, as shown in the diagram. The angle of elevation to the top of the launch tower is 13°. Twenty seconds (20s) after launch the angle of elevation of the rocket is 47°.

(i) What height has the rocket gained in 20 seconds?

(ii) Find the speed of the rocket at 'R' **3**



c) In the diagram, the points A and C lie on the y-axis and the point B lies on the x axis. The line AB has equation $y = (\sqrt{3})x - 3$. The line BC is perpendicular to AB



(i) Find the equation of the line BC. in the form $y = mx + b$ **2**

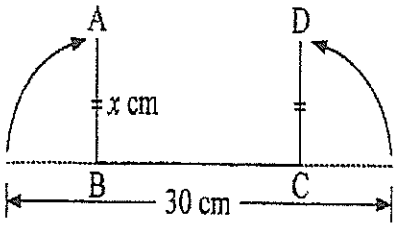
(ii) Find the area of the triangle ABC. **2**

Question 30 **(10 marks)**

Start a new sheet of paper

a) Find the value of a, to the nearest minute, of a triangle that has two sides of length 35cm and 42cm and an included angle of a°, given that the triangle's area is 120 cm^2 **2**

b) A rectangular gutter is formed by bending a 30cm wide sheet of metal as shown in the illustration below:

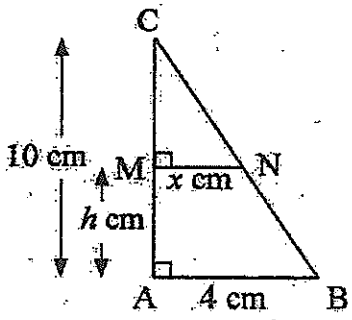


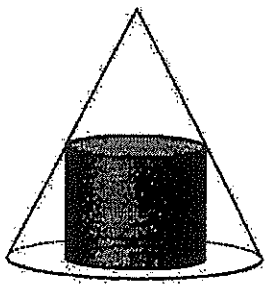
(i) If $AB = x$ cm, show that the area of the cross section of the gutter ABCD is given by $A = x(30 - 2x)$ cm^2 **1**

(ii) Where must the bends be made in order to maximise the water crried by the gutter? **1**

c) Given that A $(3,n)$, B $(2,-1)$ and C $(-1,5)$ are collinear, find n **2**

d) A cylinder fits exactly inside a right circular cone of radius 4 cm and height 10 cm such that the cylinder is just touching the cone as shown in the diagram.





(i) Prove that Δ's ABC and MNC are similar **2**

(ii) Show that $h = 10 - 2.5x$ **1**

(iii) Find the height and volume of the cylinder given that its radius is 2cm **1**

SYDNEY TECHNICAL HIGH SCHOOL

MULTIPLE CHOICE ANSWER SHEET

Name : .....

ANSWERS

Teacher: .....

Course: YEAR 10 YEARLY 2015

Completely fill the response oval representing the most correct answer.

Do not remove this sheet from the answer booklet.

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 ○
11.	A ○	B ●	C ○	D ○
12.	A ○	B ○	C ○	D ●
13.	A ○	B ○	C ○	D ●
14.	A ○	B ○	C ●	D ○
15.	A ○	B ●	C ○	D ○
16.	A ●	B ○	C ○	D ○
17.	A ○	B ○	C ○	D ●
18.	A ○	B ○	C ●	D ○
19.	A ○	B ○	C ●	D ○
20.	A ○	B ○	C ●	D ○
21.	A ○	B ○	C ○	D ●
22.	A ●	B ○	C ○	D ○
23.	A ○	B ○	C ○	D ●
24.	A ○	B ○	C ●	D ○
25.	A ○	B ●	C ○	D ○

PART B SOLUTIONS

QUESTION 26:

1 (a) 183 000 000

1 (b) $x = 9$

1 (c) $m = \frac{2g - 2g}{3}$

1 (d) $(2a - b)(2 - 3b)$

1 (e) (i) $2^{1/5}$

1 (ii) $2^{5/3}$

1 (iii) $2^{-6/5}$

1 (f) 0.3.

(g) $\sqrt{5}+2 + \frac{1}{\sqrt{5}+2} = 2\sqrt{5}$

$\sqrt{5} + 2 + \sqrt{5} - 2 = 2\sqrt{5}$

2 $\therefore b = 5$

QUESTION 27:

(a) 79° 1

(b) (i) 1920 cm^3 1

(ii) 2304 cm^3 1

(iii) $\% = \frac{384}{1920} \times \frac{100}{1}$

$= 20\%$ 2

(c) (i) $\frac{2500}{1000} \times 1238.82$ 1

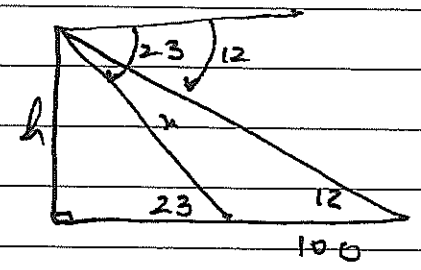
$= 3097.05$

(ii) 10000 → 15000

in 7 years. 1

(iii) $33 000 1

(d)



$\frac{x}{\sin 12°} = \frac{100}{\sin 11°}$

$x = 108.96$ 1

$\frac{h}{108.96} = \sin 23°$

$\therefore h = 42.58$ m 1

QUESTION 28:

(a) $\frac{h}{3} = \frac{5 \cdot 6}{2 \cdot 4}$ 1

$\therefore h = 7$. 1

(b) $x^2 + 7x + 5 = 25$

$x^2 + 7x - 30 = 0$

$(x - 3)(x + 10) = 0$

$x = 3$ or $x = -10$ 1 1

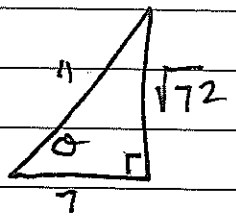
(c) a C 1

b A 1

c B 1

d D 1

(d)



$\sin\theta = \frac{\sqrt{72}}{11}$

$= \frac{6\sqrt{2}}{11}$ 1

$\cot\theta = \frac{7}{\sqrt{72}}$

$= \frac{7}{6\sqrt{2}}$ 1

QUESTION 29:

(a) (i) 24 (ii) 30 - 17

$= 13$

(b) (i) $\frac{TB}{2} = \tan 13$

$TB = 0 \cdot 46174$

$RB = 2 \tan 47$

$= 2 \cdot 14474$

$\therefore h = 1 \cdot 683$ km. 2

(ii) $S = \frac{D}{T}$

$= \frac{1.683}{20}$

$\approx 841 \cdot 5$ m/s 1

(c) $m_{AB} = \sqrt{3}$ B is $(\sqrt{3},$

$m_{BC} = -\frac{1}{\sqrt{3}}$ A is $(0, -$

BC is

$y - 0 = -\frac{1}{\sqrt{3}}(x - \sqrt{3})$

$y = -\frac{1}{\sqrt{3}}x + 1$

C is $(0, 1)$

(ii) Area $= \frac{1}{2} \times AC \times OB$

$= \frac{1}{2} \times 4 \times \sqrt{3}$

$= 2\sqrt{3}$ u^2

QUESTION 30:

(a) $120 = \frac{1}{2} \cdot 35 \cdot 42 \sin\theta$

$\sin\theta = \frac{240}{35 \times 42}$

$\theta = 9°24'$ — 2

(b)(i) A = length × height

$= x \times (30 - 2x)$ — 1

(ii) Vertex is at $x = 7\frac{1}{2}$ — 1

(c) $\frac{-1-n}{2-3} = \frac{6}{-3}$

$n + 1 = -2$

$n = -3$ — 2

(d) (i) In $\triangle ABC$ and $\triangle MNC$

$\angle CAB = \angle CMN = 90°$ (given) — 1

$\angle C$ is common — 1

$\therefore \triangle ABC \parallel\parallel \triangle MNC$ (equiangular)

(ii) $\frac{10}{10-h} = \frac{4}{x}$

$40 - 4h = 10x$ — 1

$h = 10 - 2.5x$

(iii) If $x = 2$, $h = 5$ — 1

$\therefore V = \pi(2)^2 5$

$= 20\pi$

$\approx 62.8 \text{ cm}^3$