Student Number/Name .....

THE KING'S SCHOOL

2005
Higher School Certificate
Trial Examination

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2.5 hours
- Write using a black or blue pen
- Board-approved calculators may be used
- A formulae sheet is provided at the back of this paper
- Write your student number and/or name at the top of every page

Total marks – 100

Section I Pages 2-10
Total marks (22)

- Attempt Questions 1-22.
- Answer on the Multiple Choice answer sheet provided.
- All about 30 minutes for this Section.

Section II Pages 11-23
Total marks (78)

- Attempt Questions 23-28

Allow about 2 hours for this section.

Multiple Choice		/22
Question 23		
(a)	Data	/ 4
(b)	Probability	/ 9
Question 24		
Measurement		/13
Question 25		
Financial Mathematics		/13
Question 26		
Measurement		/13
Question 27		
(a)	Financial Mathematics	/10
(b)	Measurement	/ 3
Question 28		
Algebra		/13
		100

This paper must not be removed from the examination room

1. The radius of the Earth is approximately 6400 km.
The approximate length of the Equator is:

(A) $1{\cdot}3 \times 10^8$
(B) $2{\cdot}6 \times 10^8$
(C) $2{\cdot}0 \times 10^4$
(D) $4{\cdot}0 \times 10^4$

2. Each of the 9 equilateral triangles in the design has an edge length of 12 cm.

The ratio of the perimeter of one equilateral triangle to the perimeter of the design is:

(A) 1:4
(B) 1:3
(C) 3:4
(D) 1:9

3. The value of x in the equation $x^3 = 64\pi$ written correct to 2 significant figures is:

(A) 2·3
(B) 5·86
(C) 5·9
(D) 13

4. A tax invoice includes a 10% goods and services tax (GST) of $6.33.

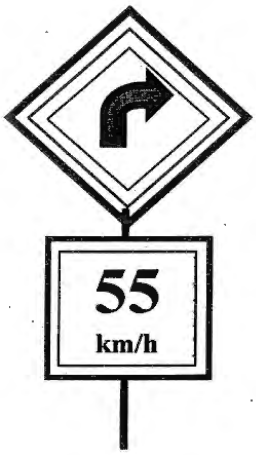
The total of the bill the customer needs to pay is:

(A) $ 63.30
(B) $ 69.63
(C) $ 93.67
(D) $106.33

5. Australian hardwood timbers are widely used as flooring in many homes and businesses.
When the forestry commission records the number of hardwood trees felled from state forests during a period, the data collected is referred to as:

(A) discrete
(B) systematic
(C) continuous
(D) qualitative

The following two questions (Questions 6 and 7) refer to the diagram below



6. The speed on the road sign in metres per second is:

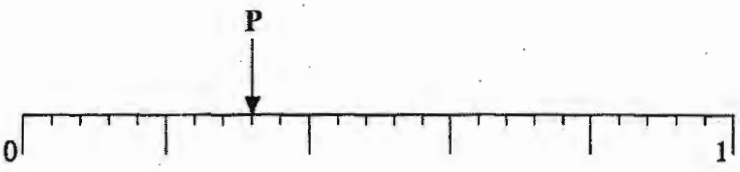
(A) 0·91
(B) 1·52
(C) 9·16
(D) 15·28

7. In an attempt to reduce the car accidents occurring on the bend at this road sign, the Roads and Traffic Authority (RTA) will reduce the speed limit to 40 km/h.

This represents a percentage reduction in speed (in km/h) around the bend of:

(A) 15
(B) 27·3
(C) 37·5
(D) 72·7

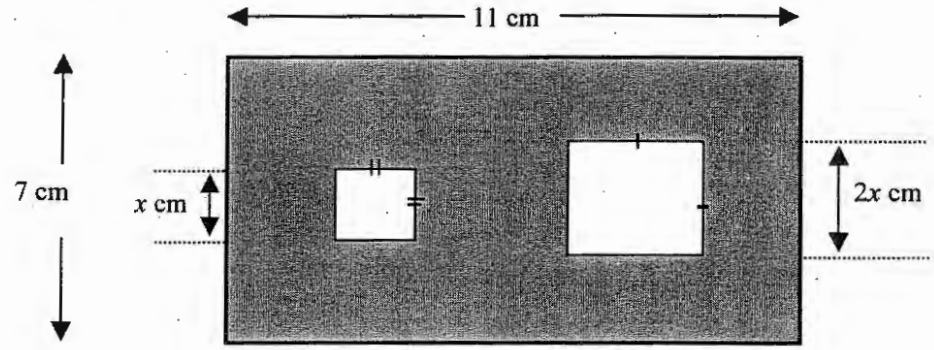
8. Sandra measures the length of a piece of string and records her measurement at P using a metre rule with gradations as shown.



What was the precision in Sandra's measurement?

(A) 0.02 m
(B) 0.04 m
(C) 0.05 m
(D) 0.32 m

9. An 11cm × 7cm rectangular power point cover plate is shown in the diagram.



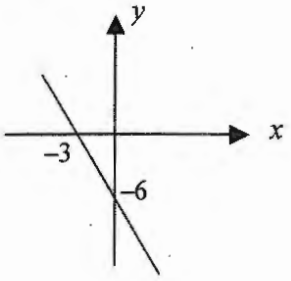
Two squares of edges x cm and $2x$ cm are cut from the plate to allow for the on/off switch and the power point.

The area of the plate remaining in square centimetres, after the squares are cut, is:

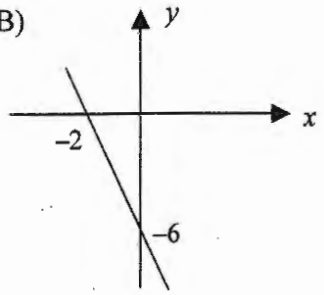
(A) $72 - x^2$
(B) $74 - x^2$
(C) $77 - 3x^2$
(D) $77 - 5x^2$

10. Which of the diagrams correctly shows the line $y = -3x - 6$?

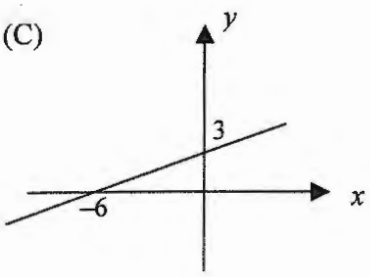
(A)



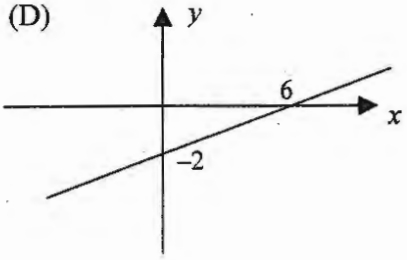
(B)



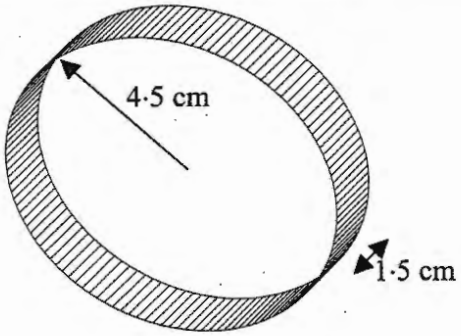
(C)



(D)



11. The radius of Christine's gold bracelet is 4·5 cm, and its width is 1·5cm.



Christine wants to clean her bracelet on both the inside and outside completely. What area in square centimetres does she need to clean?

(A) 42·4
(B) 84·8
(C) 127·23
(D) 1598·8

12. On a guitar the frequency of a note, measured in hertz (Hz), is inversely proportional to the length of a string.

A string 70 cm long produces a note with frequency 100 Hz
What is the length in cm, of a string producing a note with frequency 110 Hz ?

(A) 63·6
(B) 77
(C) 80
(D) 157

13. The table gives the longitudes of 3 world cities.

Mexico City	London	Beijing
75°W	0°	120°E

It is 2:00 am in London on Monday.

Which of the following statements is FALSE?

(A) There is a 13 hour time difference between Mexico City and Beijing.
(B) It is 9:00 pm Sunday in Mexico City.
(C) It is 10:00 pm Monday in Beijing.
(D) It is 10:00 am Monday in Beijing.

14. A plasma television was purchased new for $8650 in January 2002.

By using the declining balance method of depreciation, the value of the television in December 2004, was calculated to be $3365.

The annual percentage rate of depreciation of the television was closest to:

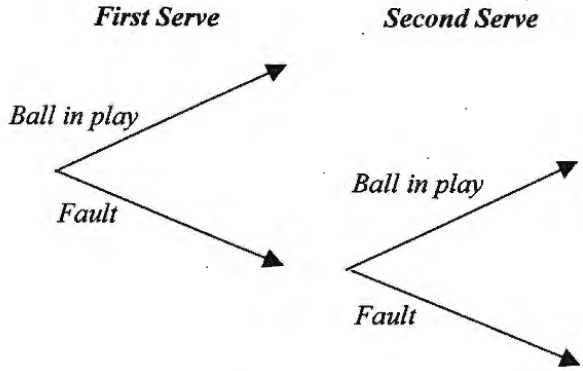
(A) 20
(B) 27
(C) 38
(D) 73

15. In how many ways can Jeremy arrange his 6 folders on the shelf?

(A) 6
(B) 9
(C) 21
(D) 720

16. In the game of tennis, a player has two attempts at getting a ball in play for every point. If the first serve fails (fault), the player serves for the second time.

The following diagram shows the possible outcomes when a player serves.



A particular player has an 85% chance of getting a ball in play for each serve.
The probability (as a percentage) that this tennis player serves a "double fault" is:

(A) 2.25
(B) 15
(C) 22.5
(D) 30

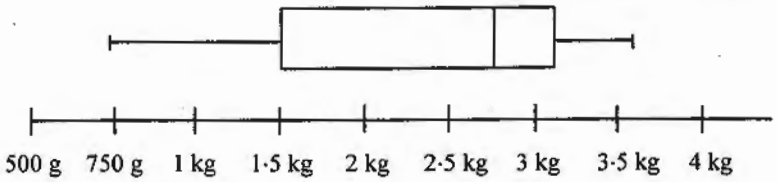
17. $(-3a^2)^4 =$

(A) $-12a^6$
(B) $-81a^8$
(C) $81a^6$
(D) $81a^8$

18. A fundraiser sells 200 tickets in a raffle for $2 each. First prize is $150, second prize $100 and third prize $50. Which of the following alterations would change the financial expectation from the purchase of one ticket in the raffle to $0 from -$0.50?

(A) decreasing the number of tickets to 150
(B) lower the ticket price to $1
(C) adding a fourth prize of $25
(D) increasing all the prizes by $50

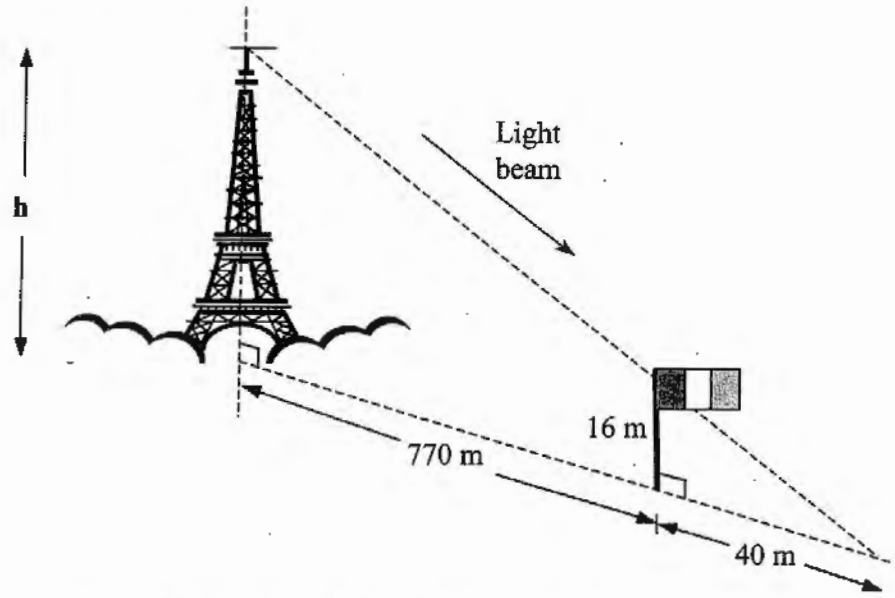
19. The weights of fish sold at a fish market were recorded in a box and whisker plot.



Which of the following statement about the recorded weights of the fish is correct?

(A) The range of weights was 1·5 kg
(B) The inter-quartile range of weights was 2·75 kg
(C) The median weight was 2·75 kg
(D) The weights were positively skewed

20. The French flag is on a 16 metre pole perpendicular to the ground at a position 770 metres from the foot of the Eiffel Tower in Paris.

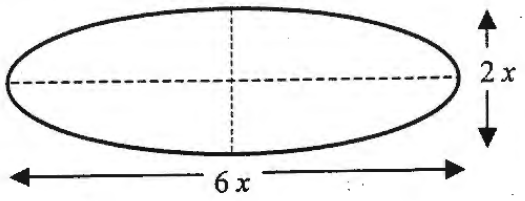


At night, a light beam shines from the top of the tower and causes the flag to cast a shadow 40 metres along the ground.

The height (h) of the Eiffel tower in metres is approximately:

(A) 202·5
(B) 308
(C) 324
(D) 746

21. The perimeter of an ellipse is given by the formula: $\pi(a+b)$ where a and b are the semi minor and semi major axes.

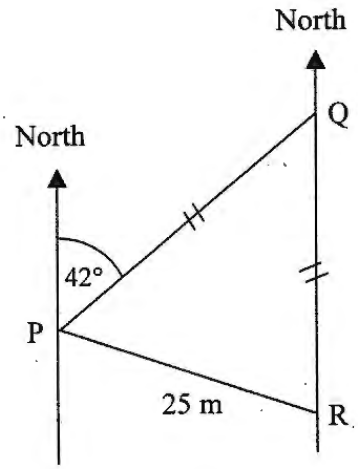


The perimeter of the above ellipse is 32π.

The area of the above ellipse in terms of π is:

(A) 32
(B) 64
(C) 192
(D) 576

22.



Which of the following calculations would correctly give the distance between P and Q?

(A) $\dfrac{25 \times Sin69°}{Sin42°}$

(B) $\dfrac{25 \times Sin42°}{Sin48°}$

(C) $25 \times Sin42° \times Sin48°$

(D) $\sqrt{25^2 + 25^2 - 2 \times 25 \times 25 \times Cos42°}$

Section II

Total marks (78)
Attempt questions 23 – 28
Allow about 2 hours for this section

Answer each question on the paper provided, beginning each new question on a new page.

Question 23 (13 marks) **Marks**

(a) At an international airport, a customer service officer of a newly operating airline was asked to record the number of flights scheduled for a particular day that were either delayed or departed on time.

The two-way table gives the results of the data collected.

	Delayed	Departed on Time
Morning flights	8	32
Afternoon flights	17	28

(i) What percentage of the flights during the day was delayed? **1**

(ii) Determine the probability that if a flight was selected at random during the day, it would have departed on time. **1**

The customer service officer decided to record the delayed times of a sample of 9 flights during the day.

The delayed times were:

35 min, 1 h 5 min, 10 min, 45 min, 1 h 10 min, 25 min, 15 min, 5 min, 10 min

(iii) Calculate the sample standard deviation for these times correct to 2 decimal places. **1**

(iv) Write down the median delayed time from these 9 flights. **1**

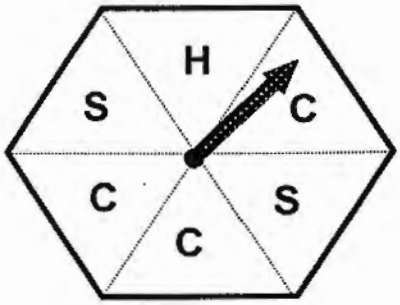
(v) Determine the inter-quartile range of the delayed times. **1**

(vi) What conclusions might the officer make from this data concerning the flights during the day? **1**
[You may use your results from parts (i) to (v) above]

Question 23 continued on next page

Question 23 (continued)

(b) The arrow on the hexagon wheel is spun three times and the letters recorded



Determine the probability that:

(i) the letter **C** occurs every time **1**

(ii) the letters **H, S, C** occur in this order **2**

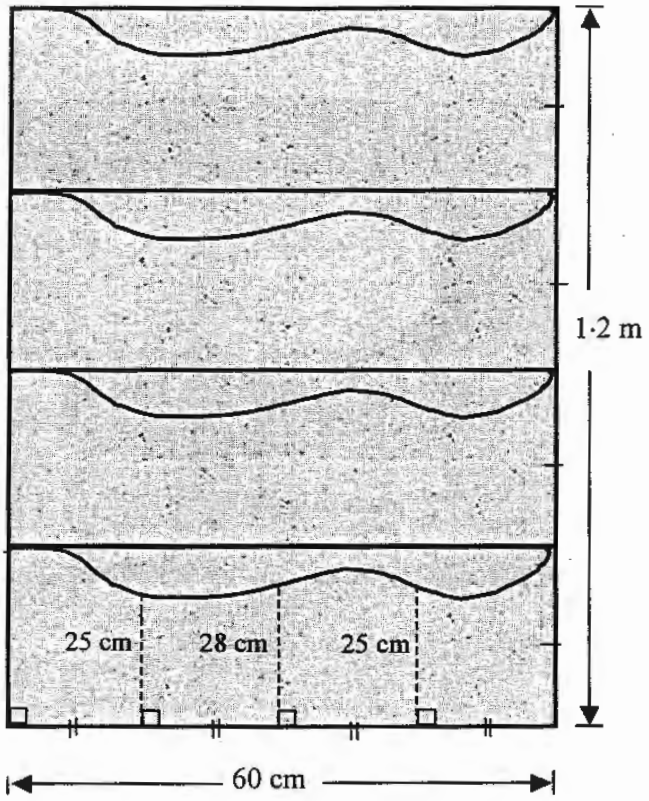
(iii) at least one **C** occurs in the three letters **2**

(iv) the letter **S** occurs as the first and third letter **2**

Question 24 (13 marks) **Marks**

Begin a new page for your answers.

(a)



From a piece of rectangular cardboard 1·2 m x 60 cm, 4 identical stencils are to be cut out and used as templates.

Perpendicular measurements are taken at equal intervals along the cardboard's width to meet the outline of the first stencil as shown above.

Using the measurements shown:

(i) determine the total area of the 4 stencils to be cut, by applying Simpson's rule twice **3**

(ii) determine the area of cardboard that will be discarded **2**

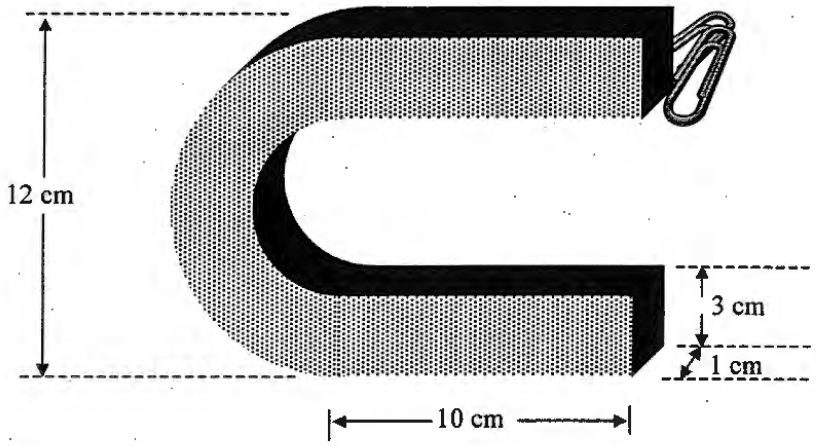
Question 24 continued on next page

Question 24 (continued) **Marks**

(b) A magnet is being tested for its magnetic force in a physics class.

The magnet is manufactured from steel 1 cm thick and moulded into a horse-shoe shape consisting of two 10cm long rectangular blocks joined to a semicircular block.

The dimensions of the magnet are shown in the diagram.



(i) Determine the radius of the inner semi circle of the magnet. **1**

(ii) Determine the radius of the outer semi circle. **1**

(iii) Calculate the total area of the front surface of the magnet. **3**

(iv) Calculate the volume of steel (in cubic centimetres) used in the manufacture of this magnet. **1**

(v) The force (attraction) F of the magnet (measured in Newtons) is directly proportional to the square root of the distance (d) an object is from it, and can be given by the formula:

$$F = k\sqrt{d}$$

A magnet with a force of 10 Newtons can attract an object 9 cm away.

From what distance can an object be attracted to a magnet with a force of 25 Newtons? **2**

Question 25 (13 marks) **Marks**

Begin a new page for your answers.

(a) (i) A single amount of $30 000 is invested in an account paying 6% p.a. interest compounded annually.
Calculate the future value of this investment after 5 years. **2**

(ii) If instead, $6000 was invested at the end of each year for 5 years at 6% p.a. interest compounded annually, determine the accumulated value of this investment. **3**

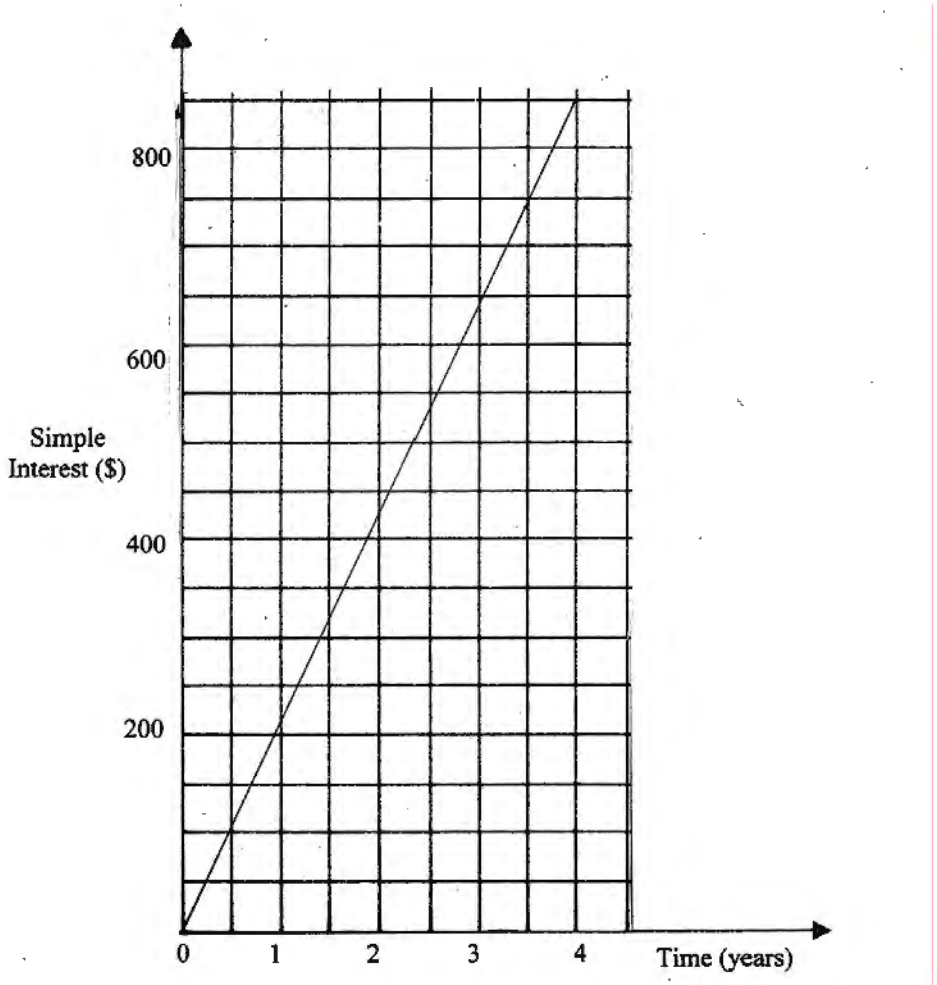
(iii) Determine the difference in interest paid on these two alternative investment strategies. **1**

Question 25 (continued) **Marks**

Begin a new page for your answers.

(b) The graph below shows the amount of simple interest paid on a single investment of $2500 over a period of 4 years.

Examine the graph and answer the questions below.



(i) On the vertical scale, what amount of interest does each division represent? **1**

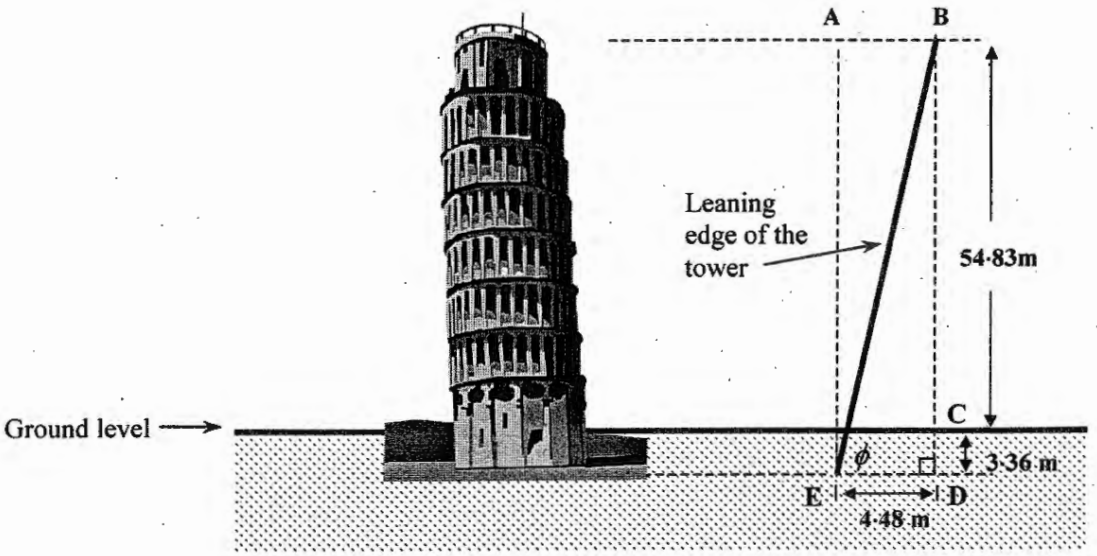
(ii) Approximately how much interest was earned over 18 months? **1**

(iii) Approximately how many months would it take to earn $475 in interest? **1**

(iv) Calculate the annual rate of simple interest earned on the investment. **2**

(v) On the separate grid provided, draw a line representing the amount of simple interest earned on $2500 at *6.5% p.a.* over 4 years.

Question 26 (13 marks) **Marks**



Engineers have for many years attempted to rectify the 'lean' of the famous Bell Tower in Pisa, Italy.

The section on the right of the diagram of the tower, shows measurements that have been determined under ground level, including the amount the tower has sunk (CD), the horizontal distance (ED) from the tower's original vertical position and the vertical height above ground level (BC) the tower now stands.

Use the measurements in the diagram to answer the following:

(i) Determine the original height, correct to two decimal places, of the tower above ground level represented by the distance EB in the diagram. **2**

(ii) Calculate the size of angle DEB, represented by ϕ in the diagram, to the nearest minute. **2**

(iii) What is the size to the nearest minute, of the lean of the tower? **1**

(iv) Calculate the length, correct to two decimal places, of the leaning edge of the tower that is above ground level. **2**

Question 26 continued on next page

(b) A structure to commemorate the new millennium has been built in Dublin, Ireland.

The structure is called a "Spire" and a diagram is shown below.

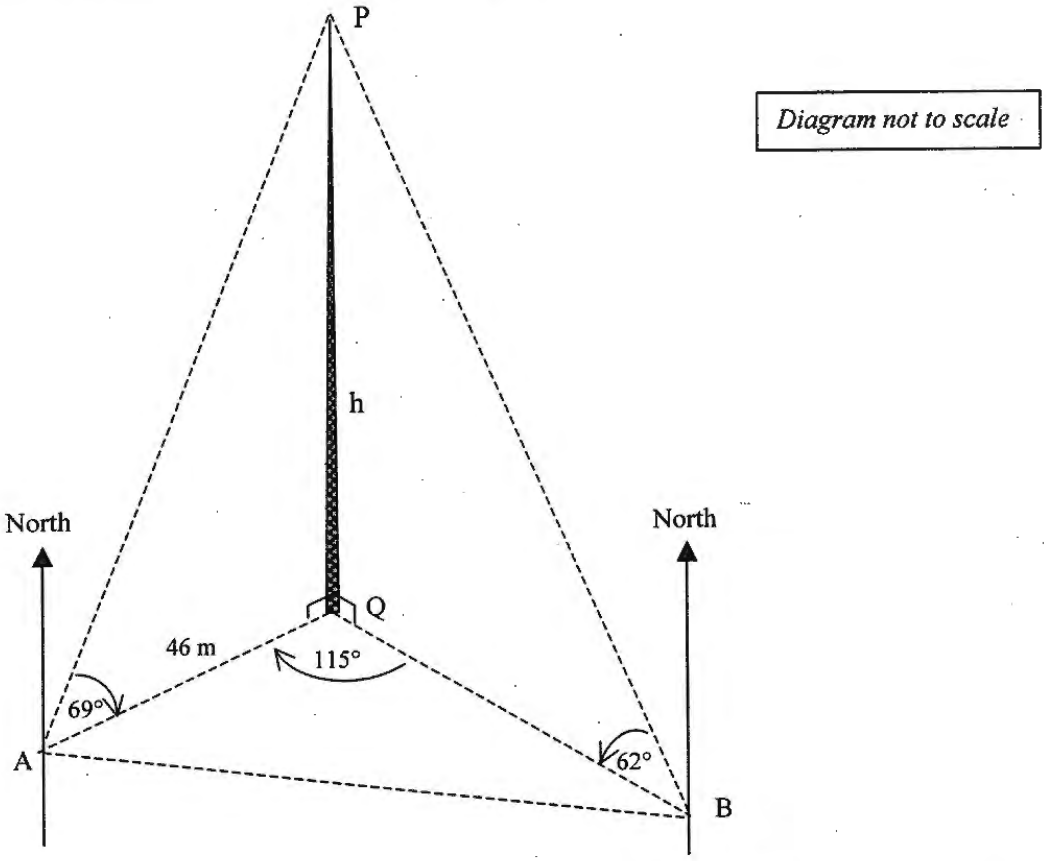


Diagram not to scale

The spire PQ stands perpendicular to the ground. Points A and B are at ground level with angles of elevation of 69° and 62° respectively, to the top of the spire.

The point A is 46 metres from the base Q of the spire, and ∠AQB is 115°.

(i) Calculate the height of the spire (h) to the nearest metre. **1**

(ii) Determine the distance of B from the foot (Q) of the spire to the nearest metre. **1**

(iii) Use the Cosine rule to calculate the distance, to one decimal place between A and B. **2**

(iv) If B is due east of A, and the bearing of the foot of the tower from A is 055°, determine the bearing of the foot of the tower from B. **2**

Question 27 (13 marks) **Marks**

(a) (i) Sam bought a new car that depreciated at $500 per month for 5 years. How much did the car cost new if its salvage value is $4000? **1**

(ii) Sam borrowed the full amount of the cost of the car and made weekly repayments of $100 for 5 years. Calculate how much he still owes on the loan. **1**

(iii) After disposing of his car Sam received its salvage value and immediately deposited it to decrease the balance of his loan. How many more weeks will it take him to pay out the loan? **1**

Question 27 continued on next page

Question 27 (continued) **Marks**

(b) Tim borrows \$250 000 as a housing loan from his credit union and agrees to repay the loan in equal monthly repayments of \$2000 over a period of 30 years.

Interest of 6.2% p.a. reducible is charged monthly on the balance owing and Tim makes each monthly repayment after the interest is added at the end of the month.

The formula: $A_n = P + I - M$ represents

A_n is the amount owing after n months
P is the principle (originally \$250 000)
I is the interest charged each month
M is the monthly repayment.

(i) What amount of interest is charged at the end of the first month of the loan? **1**

(ii) How much does Tim owe on the loan after he makes his first repayment? **1**

(iii) How much does he owe on the loan after the second monthly repayment? **1**

(iv) Over the 30 year period, how much interest would Tim pay on the loan if he continued to repay \$2000 each month? **1**

Tim wants to repay his loan at the end of 10 years and decides to increase his monthly repayments from the next month (that is, the third month of the loan)

(v) How many more monthly repayments will Tim need to make? **1**

(vi) Tim uses the following formula to calculate his new monthly repayment.

$$N = m\left\{\frac{(1+r)^n)-1}{r(1+r)^n}\right\}$$ where N is the amount owing now.

Calculate Tim's new monthly repayment (m) to the nearest dollar. **2**

[Note: assume the monthly rate of interest remains the same]

Question 27 continued on next page

Question 27 (continued) **Marks**

(c) (i) The coordinates of location X is (52°N, 144°W). Another location at Y lies in the same time zone as X but has a 110° angular difference. Give a possible set of coordinates for the location of Y. **1**

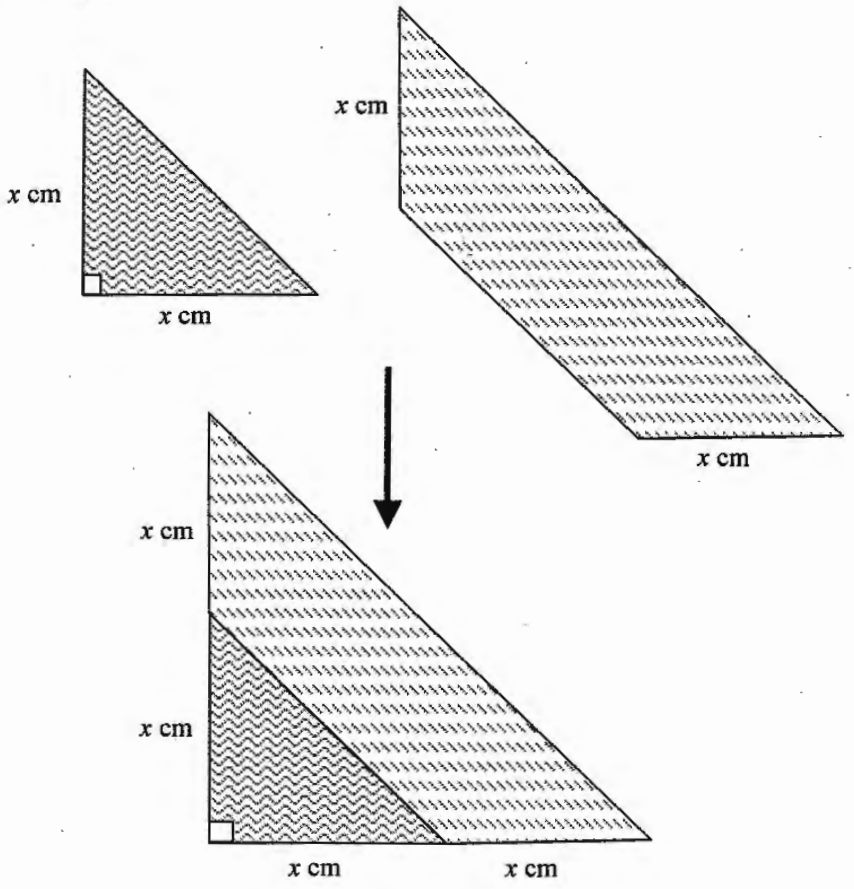
(ii) Location Z is 3000 km south of location X along the surface of the earth. Assuming the radius of the earth is 6400 km, find the coordinates of location Y to the nearest degree. **2**

Question 28 (13 marks) **Marks**

Begin a new page for your answers.

(a) Two pieces of timber cut as a right-angled isosceles triangle and a trapezium are joined together to make a larger right angled triangle.

The two shorter sides of the triangle and the ends of the trapezium are cut x cm long and the hypotenuse of the triangle and the shorter side of the trapezium are cut exactly the same length.



(i) Write down in terms of x, the area of the small triangular piece of timber. **1**

(ii) Determine the area of the larger triangle after the two pieces of timber are joined. **1**

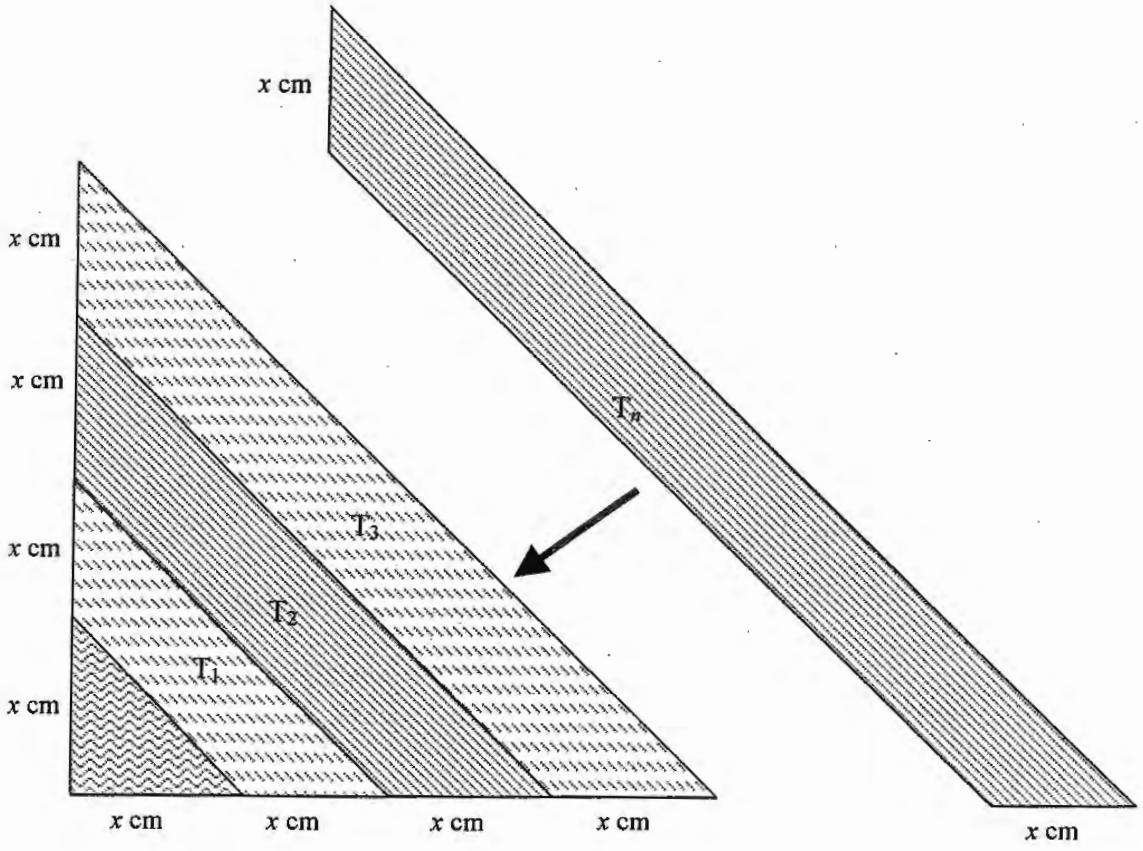
(iii) Show that the area of the trapezium shaped piece of timber is $\frac{3x^2}{2}$ **2**

(iv) Write the ratio of the areas of the small and large triangles. **1**

Question 28 continued on next page

Question 28 (continued) **Marks**

(b) Further trapezium shaped pieces of timber, with the same end size as the first piece, are joined onto the first two pieces of timber as shown:



(i) Show that the area of the second trapezium T_2 in terms of x is $\frac{5x^2}{2}$ **2**

(ii) Copy and complete the table, by writing the areas of the next two trapeziums: **2**

Trapezium	T_1	T_2	T_3	T_4
Area	$\frac{3x^2}{2}$	$\frac{5x^2}{2}$		

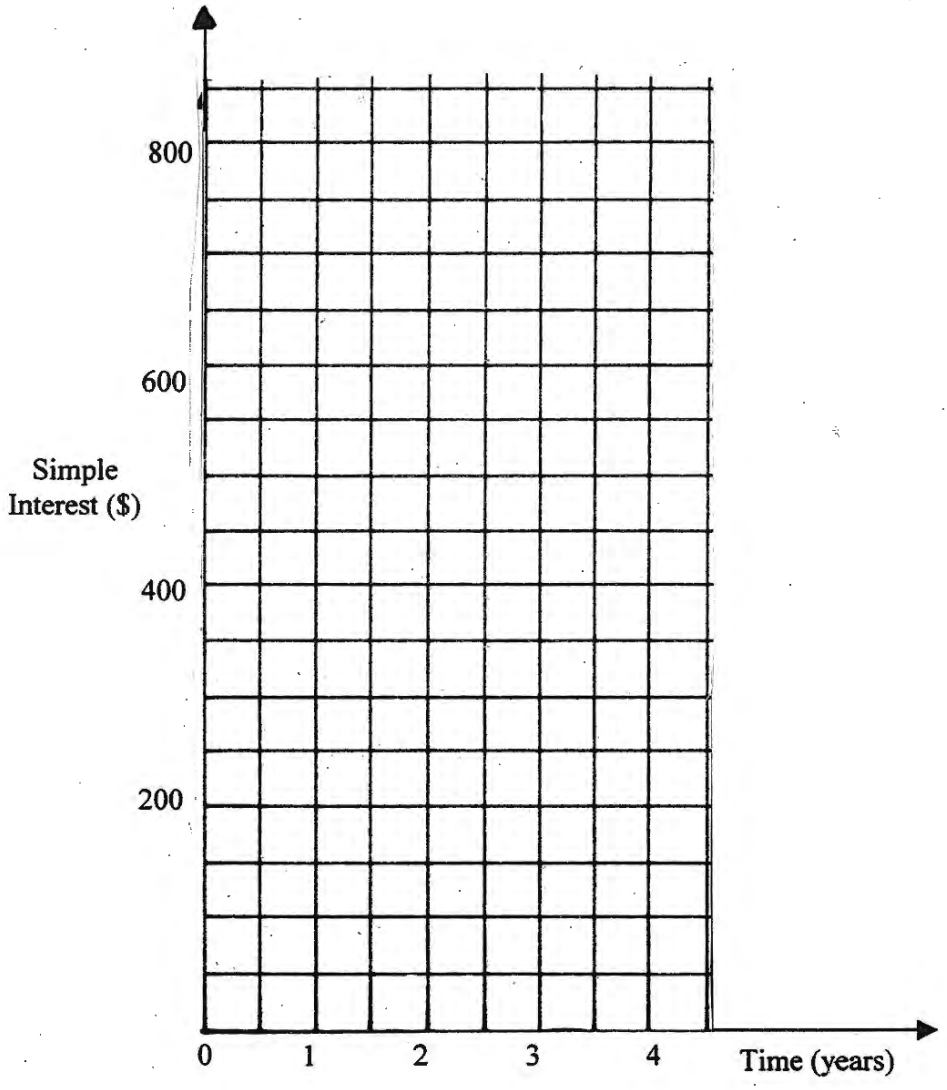
(iii) Write an expression in terms of x, for the area of the n'th trapezium T_n **2**

(iv) The area of the 10th trapezium T_{10} is 94.5 cm^2
Show that $x = 3$. **2**

End of paper

Question 26(a) Answer sheet

This sheet must be attached to your solutions to Question 26



Multiple Choice

1) D
2) B
3) C
4) B
5) A
6) D
7) B
8) A
9) D
10) B
11) B
12) A
13) C
14) B
15) D
16) A
17) D
18) A
19) C
20) C
21) C
22) A

Q 23) a) i) $\frac{(8+17)}{(8+17+32+28)} = \frac{25}{85}$

T $\frac{25}{85} \times 100 = 29.4\%$

T ii) $1 - 29.4\% = 70.6\%$

T iii) 24-34 min

(note: all times have to be converted to minutes

T iv) 25 min.

T v) 5 to | 10 15 25 35 45 | 65 ✗

10 55

I.Q.R $55 - 10 = 45$

T vi) Answers Vary. Some suggestion: Almost $\frac{1}{3}$ of flights were delayed and the median time was 25 mins with almost the same sample deviation time, so a conclusion could be that the airline might like to look into the causes of the delayed times with an aim to improve them.

23 b) i) $\left(\frac{3}{6}\right) \times \left(\frac{3}{6}\right) \left(\frac{3}{6}\right) = \frac{1}{8}$ 1

2 ii) $\frac{1}{6} \times \frac{2}{6} \times \frac{3}{6} = \frac{1}{36}$

2 iii) $1 - P(\text{no C}) = 1 - P(\text{H or S})$
$= 1 - \left(\frac{3}{6} \times \frac{3}{6} \times \frac{3}{6}\right)$
$= 1 - \frac{1}{8}$
$= \frac{7}{8}$

2 iv) $P(\text{S, any letter, S})$
$= \frac{2}{6} \times 1 \times \frac{2}{6}$
$= \frac{1}{9}$

Q24) a)

3 i) $A \doteq \frac{h}{3}(d_f + 4d_m + d_l)$

$h = \frac{60}{4} = 15\text{cm}$

$1{\cdot}2\text{m} \div 4 = {\cdot}3\text{m} = 30\text{cm}$

$A \doteq \frac{15}{3}\left[(30 + 4\times25 + 28) + (28 \times 4 \times 25 + 30)\right]$

$= 1580\text{cm}^2$

Total Area $4 \times 1580 = 6320\text{cm}^2$

2 ii) $(120 \times 60)\text{cm}^2 - 6320\text{cm}^2 = 880\text{cm}^2$

1 b) i) $\frac{12 - 2\times3}{2} = 3\text{cm}$

1 ii) $\frac{12}{2} = 6\text{cm}$

3 iii) $A = (2\times10\times3) + (\frac{1}{2}\times(6^2 - 3^2)\pi)$

$= 102{\cdot}41\text{cm}^2$

1 iv) $V = Ah \quad V = 102{\cdot}41 \times 1$

$= 102{\cdot}41\text{cm}^3$

2 v) $10 = k\sqrt{9}$

$k = \frac{10}{3}$

$25 = \frac{10}{3}\sqrt{d}$

$d = (7{\cdot}5)^2$

$d = 56{\cdot}25\text{cm}^2$

Q25) a) i) $FV = 30\,000(1{\cdot}06)^5$

2 $= \$40\,146{\cdot}77$

3 ii) $A = M\left\{\frac{(1+r)^n - 1}{r}\right\}$

$= 6000\left\{\frac{(1{\cdot}06)^5 - 1}{{\cdot}06}\right\}$

$= \$33\,822{\cdot}56$

1 iii) $\$40\,146{\cdot}77 - \$33\,822{\cdot}56$

1 b) i) \$50

1 ii) \$385 - \$330

1 iii) 2·25 yrs = 2 yrs 3 months

= 27 months

2 iv) $\frac{\$850}{4} = \$212{\cdot}50$ /year

Annual rate $= \frac{212{\cdot}50}{2500} \times 100$

$= 8{\cdot}5\%$ p.a.

2 v) See separate sheet.

Q26) a) i) $EB^2 = 4{\cdot}48^2 + (54{\cdot}83 + 3{\cdot}36)^2$

2 $= 3406{\cdot}15$

$EB = 58{\cdot}36\text{m}$

2 ii) $\tan\phi = \frac{(54{\cdot}83 + 3{\cdot}36)}{4{\cdot}48} = \frac{58{\cdot}19}{4{\cdot}48}$

$\phi = 85°36'$

1 iii) $90° - 85°36' = 4°24'$

2 iv) $\sin 85°36' = \frac{54{\cdot}83}{x}$

$x = 54{\cdot}99\text{m}$

Q26) b) i)

1 $\tan 69° = \frac{h}{46}$

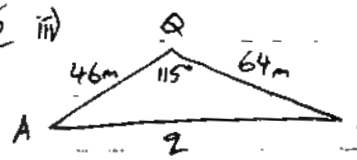
$h = 46 \times \tan 69$

$h = 120\text{m}$ (to nearest

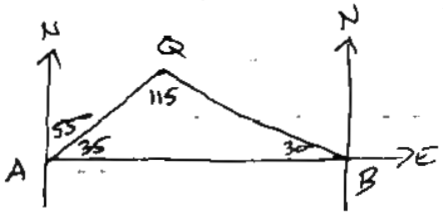
1 ii) $\tan 62° = \frac{120}{\text{Base}}$

Base = 64m (to nearest metre

2 iii)



Q26 b) iv)



$\angle BAQ = 90° - 55° = 35°$

$\angle ABQ = 180° - 35° - 115° = 30°$

The bearing of Q from B is

$270 + 30 = 300°$

Q27) a) i) $S = V_0 - D_n$

$4000 = V_0 - 500 \times 12 \times 5$

$4000 = V_0 - 30\,000$

$V_0 = \$34\,000$

ii) $34\,000 - 100 \times 52 \times 5$

$= \$8000$

iii) $8000 - 4000 = \$4000$

$\$4000 \div \$100/\text{week}$

$= 40$ more weeks.

Q27) b) i) $6{\cdot}2\%$ p.a. $= \frac{6{\cdot}2}{12}\%$ per month

Interest at end of first month

$= \frac{0{\cdot}062}{12} \times 250\,000$

$= \$1291{\cdot}67$

ii) $A_1 = \$250\,000 + \$1291{\cdot}67 - \$2000$

$= \$249\,291{\cdot}67$

iii) Interest on $\$249\,291{\cdot}67$

$= \frac{0{\cdot}062}{12} \times \$249\,291{\cdot}67$

$= \$1288{\cdot}84$

Amount owing after 2nd repayment

$= A_2 = \$249\,291{\cdot}67 + \$1288{\cdot}84 - \$2000$

b) iv) Total Repayments over 30 years

$= \$2000 \times 12 \times 30$

$= \$720\,000$

Total Interest $= \$720\,000 - \$250\,000$

$= \$470\,000$

v) 10 years = 120 repayments

He has paid 2 months, hence another 118 months to go.

vi) Using $N = \$248\,579{\cdot}68$, $r = 0{\cdot}005167$, $n = 118$.

$$\$248\,579{\cdot}68 = M\left\{\frac{(1{\cdot}005167)^{118} - 1}{0{\cdot}005167(1{\cdot}005167)^{118}}\right\}$$

$\$248\,579{\cdot}68 = M(88{\cdot}18)$

$M = \$2819$ per month

Q27 c) i) Same time zone means same line of longitude.

Going 110° North would be incorrect as different time zone, 58°S, 144°W

ii) $l = \frac{\theta}{360} \times 2\pi r$

$3000 = \frac{\theta}{360} \times 2 \times \pi \times 6400$

$\theta = 26{\cdot}86° \rightarrow 27°$

$52 - 27 = 25°$

Location Y is (25°N, 144°W)

General Maths HSC Trial 2005 Solutions

Q28) a) i) Area $= \frac{1}{2} \times x \times x$

$= \frac{1}{2}x^2 \text{ cm}^2$ [1]

ii) Area $= \frac{1}{2} \times 2x \times 2x = 2x^2 \text{ cm}^2$ [1]

iii) Area of trapezium $= 2x^2 - \frac{1}{2}x^2$

$= \frac{3}{2}x^2 \text{ cm}^2$ [2]

iv) $\frac{1}{2} : 2$

$1 : 4$ [1]

b) i) Area of triangle formed from the join of the 2nd trapezium is:

Area $= \frac{1}{2} \times 3x \times 3x$

$= \frac{9x^2}{2} \text{ cm}^2$

Area of 2nd trapezium $= \frac{9x^2}{2} - 2x^2$

$= \frac{5x^2}{2} \text{ cm}^2$ [2]

ii) $\frac{7x^2}{2}$, $\frac{9x^2}{2}$ [2]

iii) Using the pattern in the table, the nth trapezium would have area:

$(2n+1)\frac{x^2}{2} \text{ cm}^2$ [2]

iv) Using $n = 10$, in the result from (iii), we have:

$21\frac{x^2}{2} = 94.5$

$21x^2 = 189$

$x^2 = 9$

$x = 3\text{cm}$