STRATHFIELD GIRLS HIGH SCHOOL

Name: _____

Class: _____

2006

TRIAL HIGHER SCHOOL CERTIFICATE EXAMINATION

General Mathematics

General Instructions

- Reading time - 5 minutes
- Working time - $2^1/2$ hours
- Write using black or blue pen
- Calculators may be used
- A formulae sheet is provided
- Write your name and teacher's name at the top of each page.

Total marks - 100

Section I Pages 1 - 6

22 marks

Attempt questions 1 - 22

Allow about 30 minutes for this section

Section II Pages 7 - 19

78 marks

Attempt questions 23 - 28

Allow about 2 hours for this section

Exam Requirements

1 exam paper
1 formulae sheet
Multiple Choice Answer Sheet (Detach from back of exam)
1 Graph Sheet (to hand in)
10 sheets of writing paper

This is a trial examination only and does not necessarily reflect the format of the paper in the HSC

Section 1

Total marks (22)
Attempt Questions 1- 22
Allow about 30 mins for this section

Use the multiple choice answer sheet.

Select the alternative A, B, C, D that best answers the question.
Fill in the response oval completely

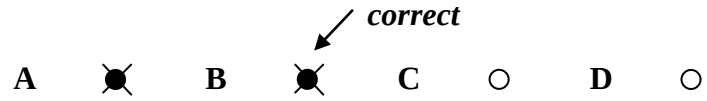
Sample **2 + 4 =** **(A) 2** **(B) 6** **(C) 8** **(D) 9**

A ○ **B** ● **C** ○ **D** ○

If you think you have made a mistake , put a cross through the incorrect answer and fill in the new answer.

A ● **B** ⊗ **C** ○ **D** ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the ***correct*** answer by writing the word correct and drawing an arrow as follows:



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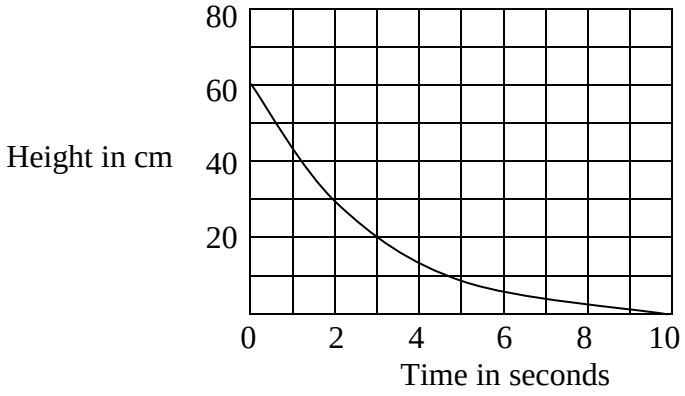
1) Which of the following is the correct simplification of $27x^9 \div 3x^3$?

(A) $3x^6$ (B) $9x^{12}$ (C) $3x^6$ (D) $9x^6$

2) A ball is dropped and allowed to bounce. The graph below shows the height of the ball over time.



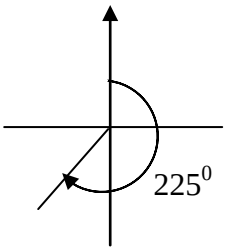
What was the initial height of the ball?

(A) 40 cm (B) 60 cm (C) 10 cm (D) 70cm

3) Refer to the graph in question 2.
How long will it take for the ball to be two-thirds of the height it was at 2 seconds?

(A) 2s (B) 3s (C) 20s (D) 30s

4)



What compass bearing is represented by the three-figure bearing in the diagram?

(A) NE (B) SE (C) SW (D) NW

5) The speed of light is 2997.925 km per second. The speed of light written in kilometres per hour is best expressed by:

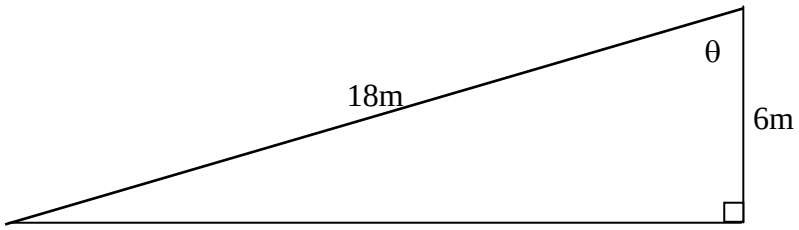
(A) 1.079×10^7 km/h (B) 1.799×10^5 km/h

(C) 4.997×10^1 km/h (D) 8.328×10^{-1} km/h

6) A normal die is rolled 240 times. How many times would you expect a number greater than 4 to be rolled?

(A) 40 (B) 80 (C) 120 (D) 160

7)



The angle θ may be determined using:

(A) $\tan\theta = \frac{18}{6}$ (B) $\cos\theta = \frac{18}{6}$

(C) $\cos\theta = \frac{6}{18}$ (D) $\tan\theta = \frac{6}{18}$

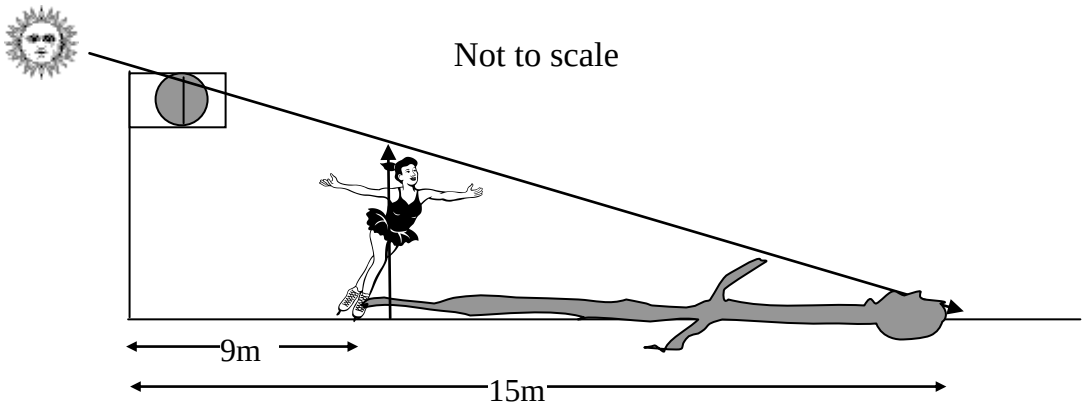
8) A cylindrical hole, which is used to pass food to miners trapped in a mine collapse, has a 10 cm diameter and is 3.32 m long. The surface area of the hole to the nearest whole cm^2 is:

(A) 104 cm^2 (B) 10430 cm^2 (C) 20360 cm^2 (D) 26075 cm^2

9) The great pyramid of Egypt has a square base of side length 230 m.
Its perpendicular height is 100 m . What is the volume of the pyramid?

(A) $5\,290\,000 m^3$ (B) $1\,763\,333\frac{1}{3} m^3$ (C) $7666\frac{2}{3} m^3$ (D) $23\,000 m^3$

10) A flagpole casts a shadow of 15 m. Ella (1.6 m tall) is standing 9 m away from the pole and casts a shadow that finishes at the same position as the flagpole.
The height of the flagpole is:



(A) 4 m (B) 2.7 m (C) 14.4 m (D) 2.4 m

11) Bishops Bank offers a credit card with no interest free period. The conditions state interest is charged at a flat rate of 22% p.a. Suzy made only one purchase of $675. She paid off the purchase completely after 55 days. The interest charged would be:

(A) $0.41 (B) $8167.50 (C) $18.31 (D) $22.38

12) Mumbai (Bombay) is 35^0 west of Perth (Australia). Ignoring time zones, the time in Mumbai when it is noon in Perth is:

(A) 9.27 am (B) 9.40 am (C) 2.33 am (D) 2.20pm

13) A Frankleans receipt showed an item including GST to be $28.16. If GST is 10%, the cost of the item without GST is:

(A) $25.34 (B) $2.33 (C) $25.60 (D) $2.82

14) Sally deposits $250 at the end of each month for 5 years into an annuity earning 8.4% p.a. compounded monthly. What single amount invested for the same time and conditions would achieve the same financial result?

(A) $12213.97 (B) $18562.01 (C) $2691.67 (D) $63 000.00

Use the table below to answer Questions 15 and 16.

A stem and leaf plot of the number of words found on a page is shown below.

Stem	Leaf
1	2
2	1 3 5 5 7
3	1 2 2 3
4	5 6
5	5

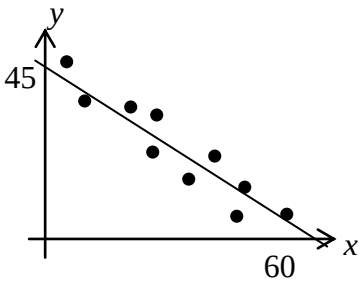
15) The average number of words found on a page (to 1 decimal place) is:

(A) 31.0 (B) 27.0 (C) 11.2 (D) 31.3

16) The interquartile range is:

(A) 43.00 (B) 15.00 (C) 11.15 (D) 11.60

17)

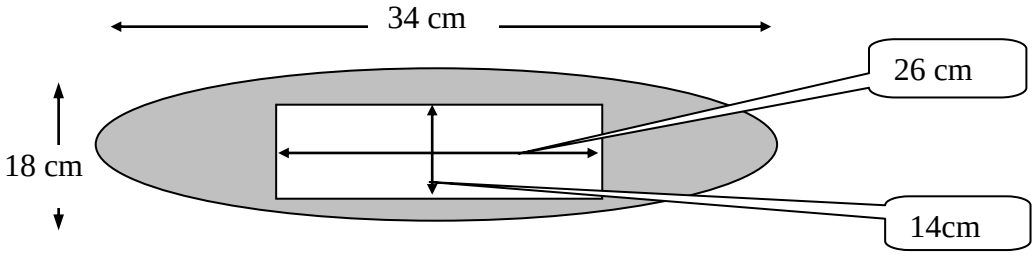


The equation of the line is:

(A) $y = 1^1/_3\, x + 45$ (B) $y = {}^3/_4\, x + 45$

(C) $y = -1^1/_3\, x + 45$ (D) $y = -{}^3/_4\, x + 45$

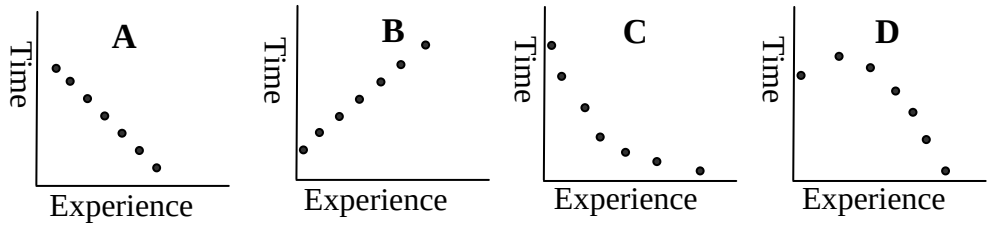
18) The area of the shaded section shown is determined using:



(A) $A = \pi \times (17 \times 9 - 13 \times 7)$ cm^2 (B) $A = 34 \times 18 - \pi \times 14 \times 26$ cm^2

(C) $A = 17 \times 9 - \pi \times 26 \times 14$ cm^2 (D) $A = \pi \times 9 \times 17 - 26 \times 14$ cm^2

19) The time taken to write a Trial HSC General Mathematics exam varies inversely to the teacher's course experience.
Which graph best represents this relationship?



20) Sarung buys an entertainment unit from Hardly Normal for $ 3762 on interest free terms. She must pay one third deposit, make monthly instalments over 3 years and is charged an account keeping fee of $1.40 per month. How much will be paid each month?

(A) $36.23 (B) $67.67 (C) $71.07 (D) $105.90

21) Jason cut lengths of timber to make a picture frame as shown in the diagram below. What should the length of the diagonal be, correct to 2 decimal places, for the frame to contain right angles?

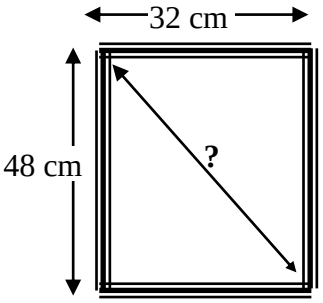


Diagram not to scale

(A) 57.69 cm (B) 69.77 cm (C) 80.00 cm (D) 35.78 cm

22) Two dice are rolled and their sum recorded.
The probability of <u>not</u> getting a sum of 6 is:

(A) $\frac{5}{36}$ (B) $\frac{31}{36}$ (C) $\frac{11}{36}$ (D) $\frac{25}{36}$

Section II

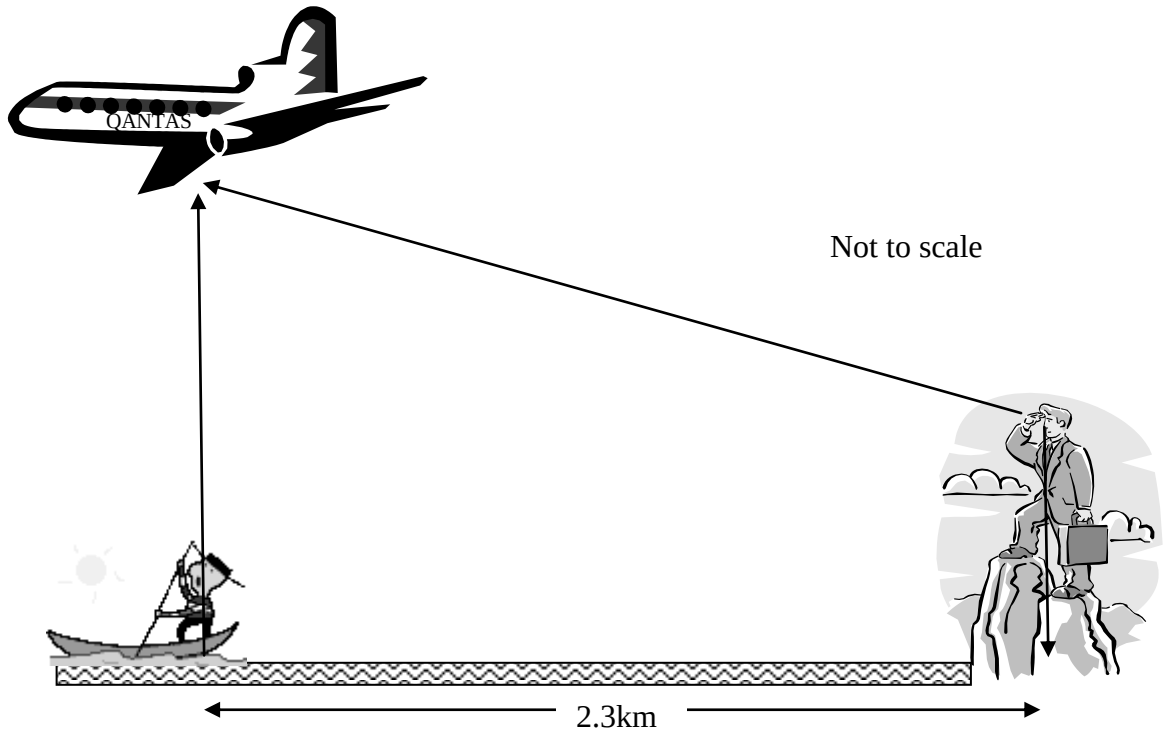
78 Marks
Attempt Questions 23 - 28
Allow about 2 hours for this section.

Answer each question on a SEPARATE sheet of paper. Extra paper is available.

All necessary working should be shown in every question.

Question 23 (13 marks) **Marks**

(a) Nick is standing on the top of a cliff and his eyes are 1045m above sea level. He can see a boat and a plane. The pilot is flying at an altitude of 1670m and at that instant is directly above the boat.



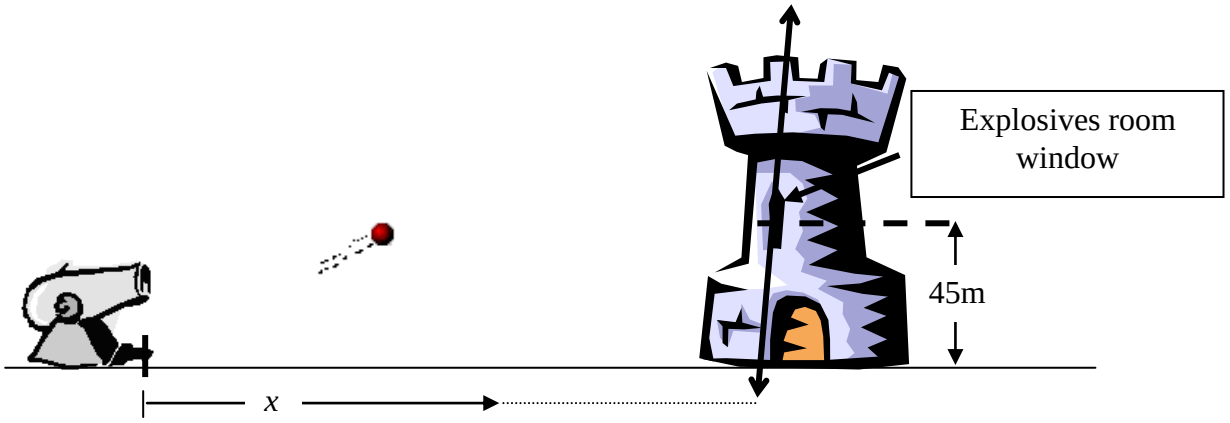
(i) Find the area, in square metres, bounded by Jim's eyes, the ground directly below him, the boat and the plane. Answer correct to three significant figures. **2**

(ii) Determine the angle of depression from the plane to Jim's eyes. Answer to the nearest degree. **2**

Question 23 continued on page 8

Marks

(b) A cannon ball is fired from a gun and travels on a trajectory given by the equation $h = \frac{73}{100}x - \frac{3x^2}{1000} + 3$ where x is the distance travelled horizontally and h is the height above the ground.



(i) Copy and complete the table of values. **2**

x	0	50	100	150	200	250
h						

(ii) **On the graph paper provided,** use your table of values to sketch the trajectory of the cannon ball. **1**

(iii) Estimate the maximum height reached by the cannon ball. Justify your answer. **2**

(iv) What are the limitations of this model of the cannon ball's trajectory? **1**

(v) The height of the side wall of the castle is shown by the straight line on the graph paper you used for part (ii). Estimate how far the base of castle is from the cannon. **1**

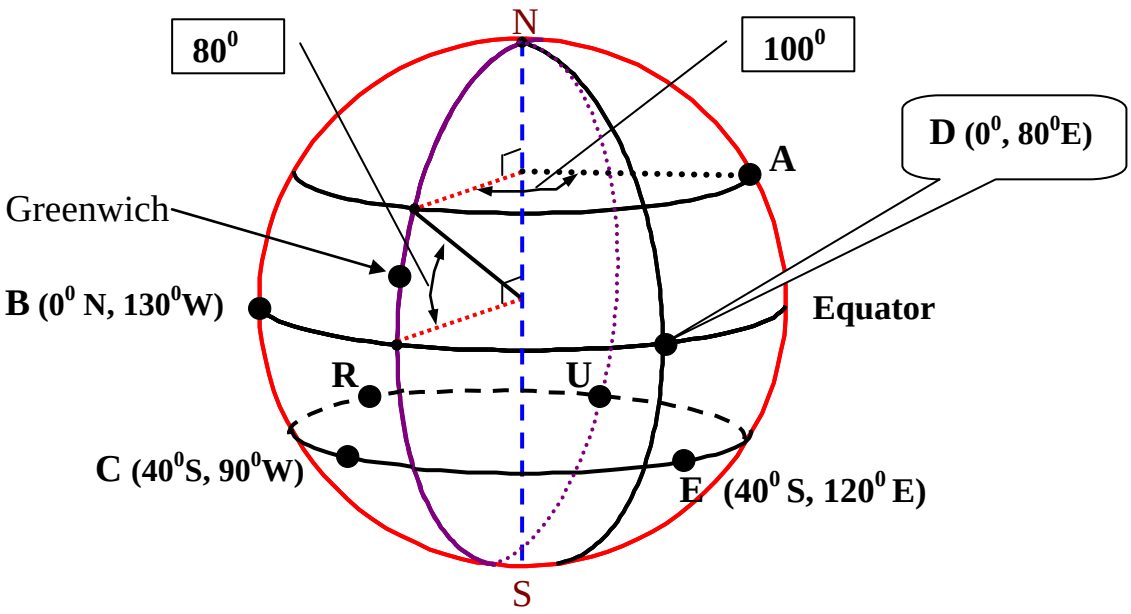
(vi) The castle's explosives room window is 45 m above the ground. Could the cannon ball hit the explosives room? By using the graph in part (ii) or by other means, justify your answer. **2**

End of Question 23

Question 24 (13 marks) Use a SEPARATE writing booklet. **Marks**

(a) In this question use:
R = 6367 km to be radius of the earth and
1 nautical Mile (M) = 1.852 km.

Natalie and Cindy are entering the *Amazing Race* challenge and need help to determine some times and distances.



(i) What is the position of A? **1**

(ii) 1) Find the distance when travelling east from B to D. Answer to the nearest kilometre. **2**

2) Find this distance BD in nautical miles to the nearest nautical mile. **1**

(iii) How long, in hours and minutes, would it take Natalie and Cindy to travel east from B to D in a plane flying at an average speed of 430 knots? **1**

(iv) What time and date is it at E(40°S,120°E) when it is 5.30 am on 17/6/06 at C(40°S,90°W)? **2**

Question 24 continued on page 10

(b) Catherine is saving for a holiday and has decided to borrow $11 000. She has chosen an account that charges 4% per annum calculated monthly for 3 years.

Monthly repayments - reducing balance loan per $1 000					
	Term in Years				
Interest rate p.a.	**2**	**3**	**4**	**5**	**6**
3 %	42.98	29.081	21.13	17.97	15.19
3.5 %	43.20	29.30	21.36	18.19	15.42
4 %	43.42	29.52	21.59	18.44	15.65
4.5 %	43.65	29.75	21.80	18.64	15.87

(i) Use the table above to calculate Catherine's monthly repayment. **1**

(ii) Calculate the interest to be paid on this loan. **2**

(iii) Catherine could invest this loan in a "SUPER" account offering 4.2% simple interest for a fixed term of 3 years. Determine the interest gained if she invests the $11 000. **1**

(iv) Her friend Sophie advised Catherine that she would be financially better off if she borrowed the money and then invested it in the "SUPER" account. Justify Sophie's statement and give mathematical evidence. **2**

End of Question 24

Question 25 (13 marks) Use a SEPARATE writing booklet. **Marks**

(a) Arven invested $950 in a bank offering 0.8 % monthly interest. **2**
How long (to the nearest month) will it take for the investment to first compound to $1140?

(b) For achieving a Band 6 in her HSC General Mathematics exam, Sam's parents gave her an unexpected gift of a large sum of money. **3**
When asked how they could afford it, her parents explained that when she was born they deposited $100 at the end of each quarter into an account that earned 2% per quarter interest until they withdrew it 17 years later.

How much was her gift to the nearest dollar?

(c) Katherine wants to buy a new Volkswagon "BUG" when she finishes her degree in 6 years time.

(i) If the car will cost $64 013 in 6 years time, where car prices are tied to an inflation rate, compounding at 4% p.a, what is the cost of a new Volkswagon now? Answer to the nearest dollar. **2**

(ii) If she wishes to purchase the car at a price of $64 013 in 6 years time, how much must Katherine deposit each month into an annuity that compounds monthly at a rate of 4 % p.a.? **2**

Question 25 continued on page 12

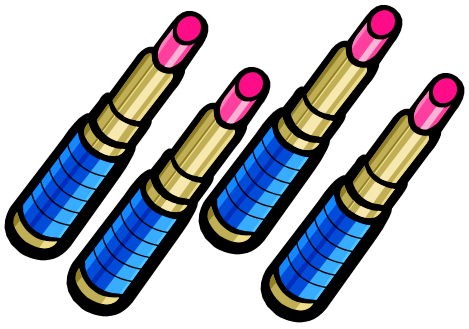
(d) The incidence of the number wrinkles on a woman's face is proportional to the square of her age.

(i) A 28 year old woman counted 5 wrinkles. Determine the constant of proportionality, k, to two significant figures. **2**

(ii) Determine the number of wrinkles an 80 year old woman would expect to find. **1**

(e) A saleswoman wishes to determine the number of different lipsticks her company can produce. The lipsticks are available in 6 colours, 4 fragrances and 3 different cases. **1**

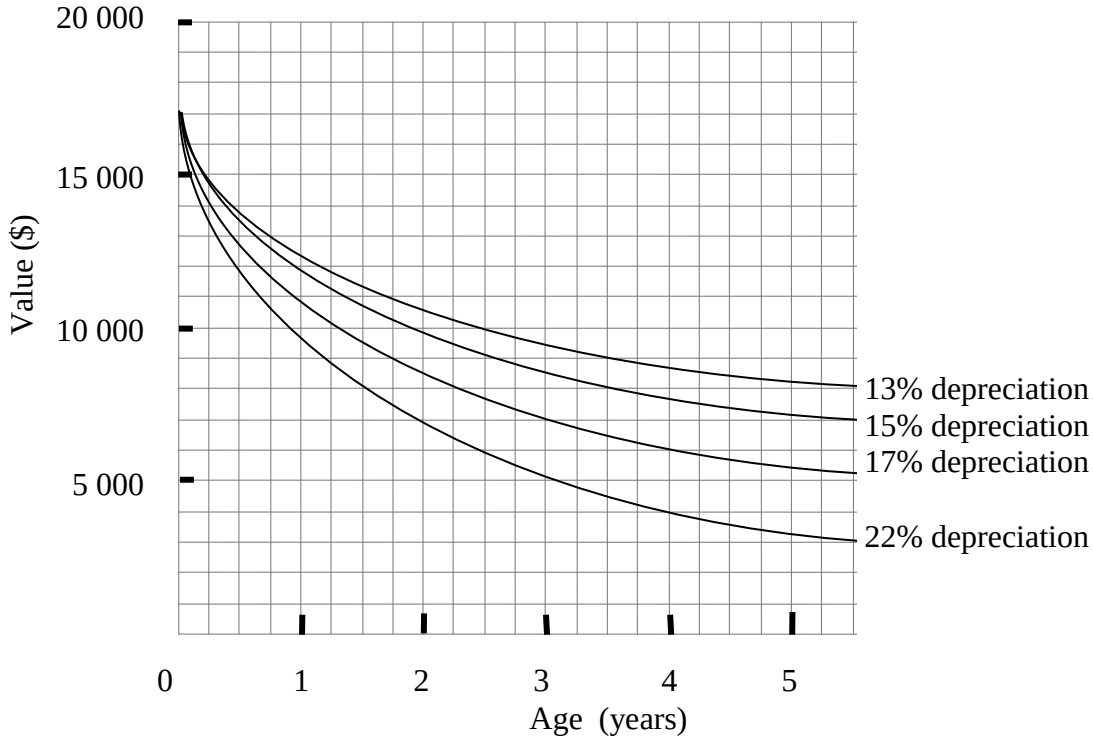
How many different lipsticks can her company produce?



End of Question 25

Question 26 (13 marks) Use a SEPARATE writing booklet. **Marks**

(a) Maree bought a new car. The graph shows how its value depreciates over time.



(i) By looking at the curves in the graph above, determine which percentage rate of depreciation best models the data given in the table below. **1**

Age years	Value ($)
1	12 000
2	9 800
3	8 500
4	7 700
5	7 100

(ii) What was the purchase price of Maree's car? **1**

(iii) Use the **declining balance formula** and the percentage rate of depreciation, chosen in (i), to show that the value of Maree's car when it is 6 years old will be $6 410 to the nearest ten dollars. **2**

Question 26 continued on page 14

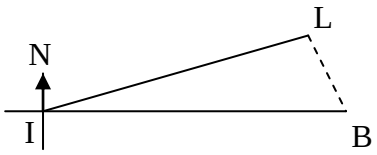
(iv) If, instead, depreciation occurs at a rate of \$600 p.a. determine the salvage value of Maree's car when it is 6 years old. **1**

(v) Six years after Maree bought the car she started a career as a sales person. This enabled her to claim a tax deduction on the depreciation on her car for that year after she had worked a year. (ie the 7^{th} year). **2**

The taxation office allowed her to choose the type of depreciation; declining balance or straight line.

Determine the best type of depreciation for Marie and calculate her tax deduction to the nearest ten dollars if the straight line depreciation is \$600 p.a. and the declining balance rate is 15% pa.

b) Sally and Dougal were travelling by car due east from *Ignorance* (I) to *Blissville* (B). *Blissville* is located 402 km due east of *Ignorance*. Unfortunately they had misread their compass and ended up at a place called *Lost* (L) on a bearing of 073^{o}T from *Ignorance*.
Their speedometer indicated that they had travelled 342 km.



(i) Copy the diagram onto your exam answer sheet and mark on all the information given above. **1**

(ii) Find the size of <LIB. **1**

(iii) Find the distance between Lost and Blissville. **2**

(iv) Find the new bearing that Sally and Dougal will have to take to get from Lost to Blissville. **2**

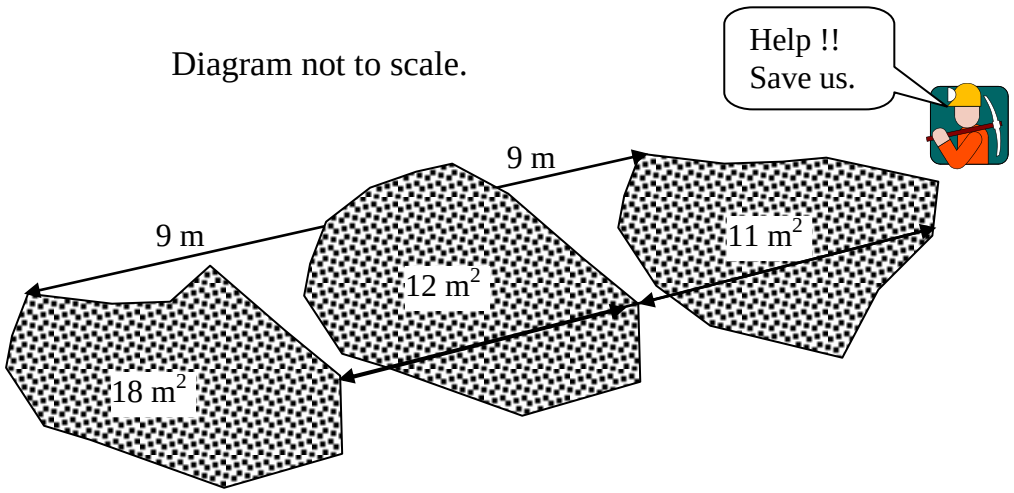
End of Question 26

Question 27 (13 marks) Use a SEPARATE writing booklet.

Marks

(a) Engineers have estimated three cross-sectional areas to be excavated to save two trapped miners in Tasmania.
Each sectional area indicated is 9 m apart.

Diagram not to scale.



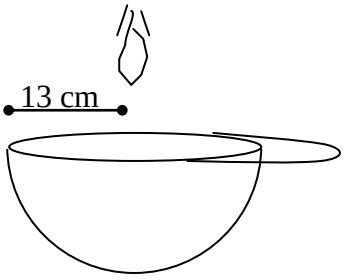
(i) By using one application of Simpson's rule determine the approximate volume to be excavated. **2**

(ii) Miners can remove the rock at a rate of 0.8 m^3 per hour. If 285m^3 of rock has to be excavated, and they work continuously, how many days will it take before the miners are rescued? **2**

(iii) Water drips into the area in which the miners are trapped at a rate of 288 drips per hour and 1.6 drips = 1 ml.

1) What volume of water drips in one day? **1**

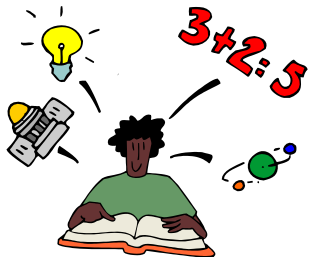
2) A miner's hard hat is shaped like a hemisphere with a 13 cm radius, as shown below. How long will it take for the dripping water to fill the hat? **2**



Question 27 continued on page 16

Marks

(b) Trial General Maths HSC papers at SGHS are known to be hard.

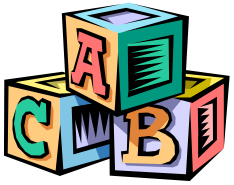


(i) Arima sat the trial in 2006 and achieved a mark of 60 as a raw mark. The average mark was 45 with a standard deviation of 10. Calculate her z-score. **1**

(ii) Marks were moderated for reports and the trial was scaled to a mean of 50 with a standard deviation of 12. Determine her moderated report mark if she maintains the same z-score as calculated in part (i). **1**

(iii) Arima didn't achieve the UAI that she had hoped for in 2005 and so was repeating the HSC in 2006. In her previous trial paper (2005) she scored 67. This exam had a mean of 50 and a standard deviation of 18. Her parents suggested that she is not working hard enough. Explain, with the use of necessary calculations, why she is performing better this year. **2**

(c) The volume of a cube lies between 18 cm ^{3} and 27 cm ^{3} (ie its lower limit is 18 cm ^{3} and its upper limit is 27 cm ^{3}).



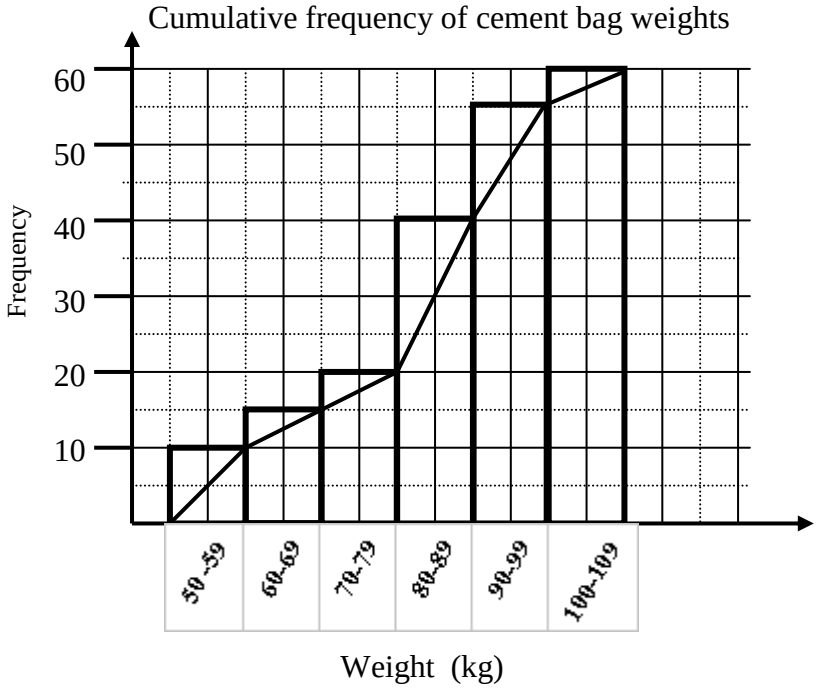
(i) Find the limits of accuracy of the length of a side. (ie the lower and upper length limits) **1**

(ii) Determine the accuracy (absolute error) of the measuring instrument used. **1**

End of Question 27

Question 28 (13 marks) Use a SEPARATE writing booklet. **Marks**

(a) Arvind sampled the weight of Super Cement bags and drew a Cumulative Frequency histogram and polygon as shown below.



(i) How many bags were weighed in the 90-99 class? **1**

(ii) Estimate the median weight of the bags surveyed. **1**

(iii) If 2400 bags were weighed individually, how many would you expect to weigh less than 80 kg? **1**

(iv) Arvind's employer orders 60 pallets of cement bags. Each pallet contains 60 bags.
Arvind's employer wants to take a sample of the weights of the bags to get an idea of the amount of cement they have. He suggests that it would be easiest to choose the first pallet of 60 bags as their sample and to record the weight of each bag from this first pallet.

1) Is this sampling method fair? Why or why not? **1**

2) Describe a different method that could be used to select a fair sample of bags. **1**

Question 28 continued on page 18

(b) A median regression line below indicates the number of hours per week (t) students spent in Year 11 learning to use a graphics calculator against their General Mathematics HSC Exam results as a percentage (R).

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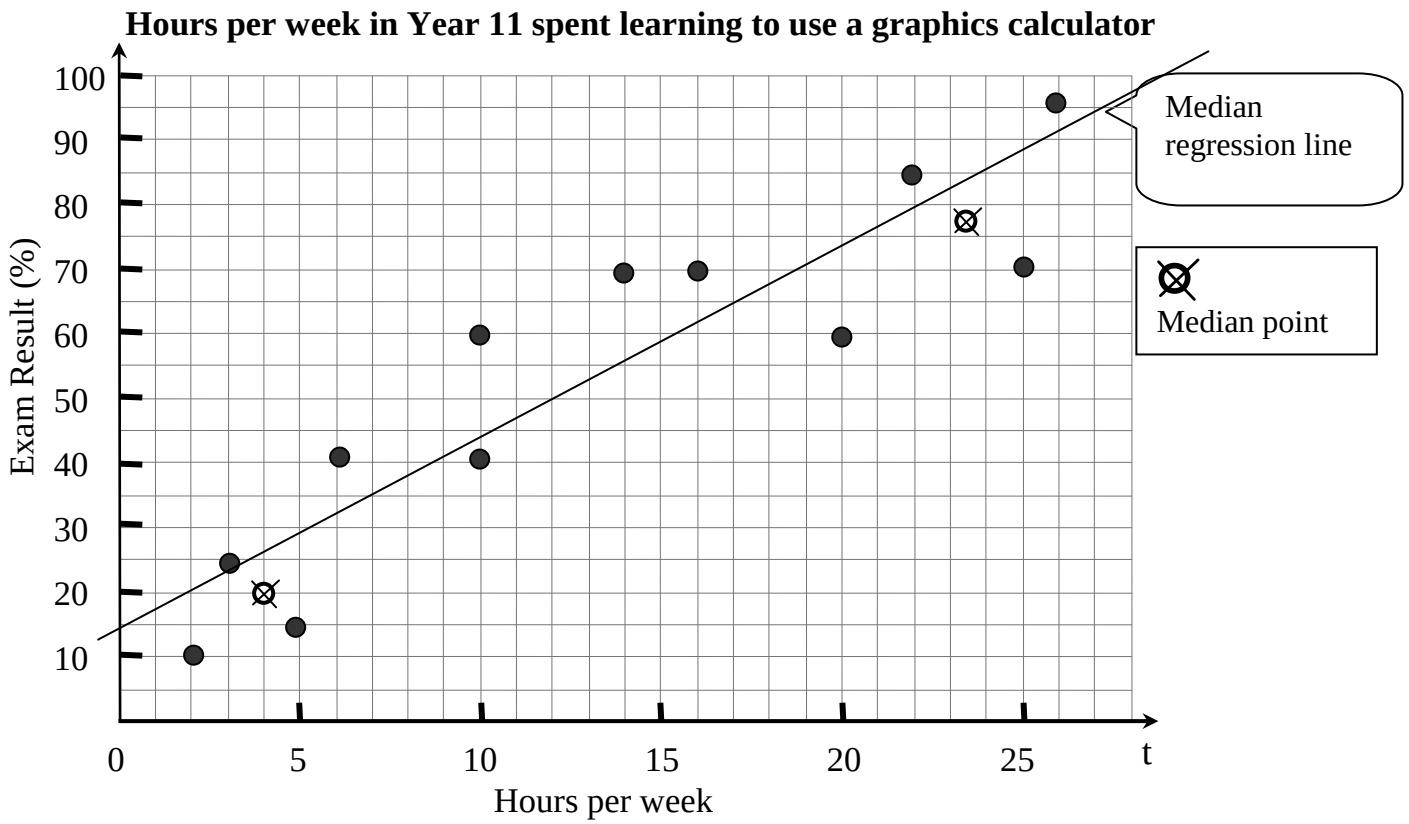


(i) Describe the correlation, if any, that exists between the two variables. **1**

(ii) State the values of the missing middle median point for the median regression line. **1**

(iii) Predict the General Mathematics result of a student who spent about 30 hrs per week learning how to use her graphics calculator in Year 11 if the regression line equation is $R = 3t + 15$ **1**

(iv) Is your answer in part (iii) reasonable? Explain why or why not. **1**

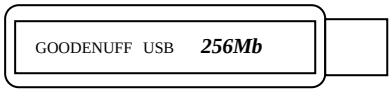
(c) Yusra took out a loan of $18 000 for an overseas holiday. She accepted a loan from D'bank with monthly repayments of $350 for 5 years.

(i) Determine the total interest paid by Yusra. **1**

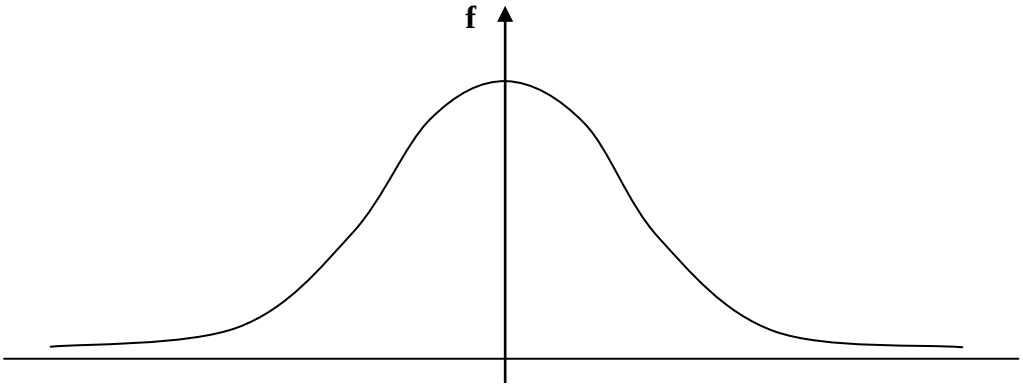
(ii) Calculate the simple interest rate p.a. **1**

Question 28 continued on page 19

(d) Goodenuff Manufacturing produce "thumb drives" (RAM) for personal computers.



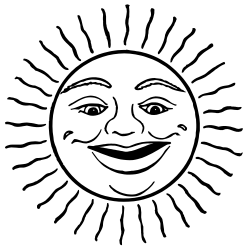
Their quality control testing for useable RAM produced a normal distribution graph as shown below. The standard deviation of a production sample of 500 "thumb drives" was 2Mb. The mean number of RAM is 262Mb.



(i) What percentage of "Thumb Drives" will have more than 264Mb and less than 268Mb of useable memory? **1**

(ii) Goodenuff produce 5 million "Thumb Drives" per year. Their warranty indicates that any "Thumb Drive" with less than 256 useable megabytes would be replaced free of charge. How many units would they expect to replace under the warranty each year? **1**

End of Trial HSC Exam 2006

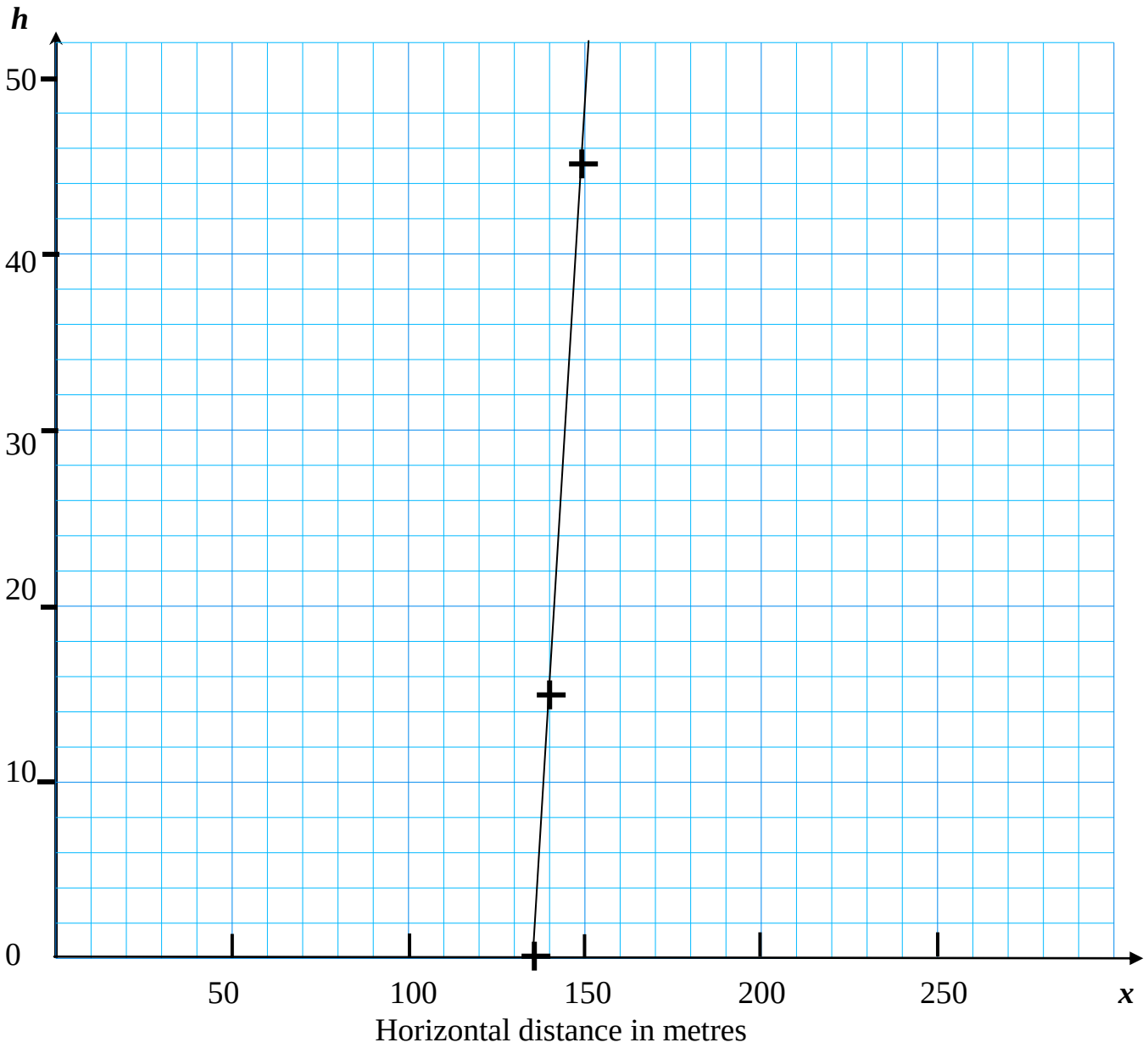


Good Luck in your HSC & your future careers from Mr Springall.

Graph for Q 23 (b) (ii)
This graph must be detached and handed in with your exam.

Student Name: _____ Teacher : _____

School name: _____



FORMULAE SHEET

Area of an annulus

$A = \pi\left(R^2 - r^2\right)$

R = radius of outer circle

r = radius of inner circle

Area of an ellipse

$A = \pi ab$

a = length of semi-major axis

b = length of semi-minor axis

Area of a sector

$A = \dfrac{\theta}{360}\pi r^2$

θ = number of degrees in central angle

Arc length of a circle

$l = \dfrac{\theta}{360}2\pi r$

θ = number of degrees in central angle

Simpson's rule for area approximation

$A \approx \dfrac{h}{3}\left(d_f + 4d_m + d_l\right)$

h = distance between successive measurements

d_f = first measurement

d_m = middle measurement

d_l = last measurement

Surface area

Sphere $A = 4\pi r^2$

Closed cylinder $A = 2\pi rh + 2\pi r^2$

r = radius

h = perpendicular height

Volume

Cone $V = \dfrac{1}{3}\pi r^2 h$

Cylinder $V = \pi r^2 h$

Pyramid $V = \dfrac{1}{3}Ah$

Sphere $V = \dfrac{4}{3}\pi r^3$

r = radius

h = perpendicular height

A = area of base

Sine rule

$\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Area of a triangle

$A = \dfrac{1}{2}ab\sin C$

Cosine rule

$c^2 = a^2 + b^2 - 2ab\cos C$

or

$\cos C = \dfrac{a^2 + b^2 - c^2}{2ab}$

FORMULAE SHEET

Simple interest

$I = Prn$

P = initial quantity
r = percentage interest rate per period, expressed as a decimal
n = number of periods

Compound interest

$A = P(1+r)^n$

A = final balance
P = initial quantity
n = number of compounding periods
r = percentage interest rate per compounding period, expressed as a decimal

Future value (A) of an annuity

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

M = contribution per period, paid at the end of the period

Present value (N) of an annuity

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

or

$$N = \frac{A}{(1+r)^n}$$

Straight-line formula for depreciation

$S = V_0 - Dn$

S = salvage value of asset after n periods
V_0 = purchase price of the asset
D = amount of depreciation apportioned per period
n = number of periods

Declining balance formula for depreciation

$S = V_0(1-r)^n$

S = salvage value of asset after n periods
r = percentage interest rate per period, expressed as a decimal

Mean of a sample

$$\overline{x} = \frac{\sum x}{n}$$

$$\overline{x} = \frac{\sum fx}{\sum f}$$

$\overline{x}$ = mean
x = individual score
n = number of scores
f = frequency

Formula for a z-score

$$z = \frac{x - \overline{x}}{s}$$

s = standard deviation

Gradient of a straight line

$$m = \frac{\text{vertical change in position}}{\text{horizontal change in position}}$$

Gradient–intercept form of a straight line

$y = mx + b$

m = gradient
b = y-intercept

Probability of an event

The probability of an event where outcomes are equally likely is given by:

$$P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Graph for Q 23 (b) (ii)

Student Name: _____ Teacher : SOLUTION

School name: _____