Newington College

2012

TRIAL HSC EXAMINATION

General Mathematics

General Instructions

- Reading time – 5 minutes
- Working time – 2½ hours
- Write using black or blue pen
- Board approved calculators may be used
- A formulae sheet is provided at the back of this paper

Total Marks – 100

Section I Pages 2– 9

22 marks

- Attempt Questions 1–22
- Allow about 30 minutes for this section

Section II Pages 10–20

78 marks

- Attempt Questions 23–28
- Allow about 2 hours for this section

Section I

22 marks
Attempt Questions 1–22
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1–22.

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1. Jan is paid a retainer of $250.00 per week and commission of 6.5% of her sales. What does she earn in a week where her sales total $8500.00?

   (A) $1 100.00 (B) $568.75

   (C) $552.50 (D) $802.50

2. Which of the following is **not** equal to $15x^3y^2$?

   (A) $7x^3y^2 + 8x^3y^2$ (B) $3x^2y \times 5xy$

   (C) $\frac{30x^5y^2}{2x^2y}$ (D) $30x^3y^2 - 15x^3y^2$

3. A statistician was hired to estimate the number of fish in a lake. In his first sample, 2 400 fish were taken from the lake, tagged and returned to the lake. The next day a random sample of 5000 fish was caught and contained 1955 tagged fish.
   The approximate number of fish in the lake was calculated to be:

   (A) 9 355
   (B) 7 400
   (C) 6 138
   (D) 6 955

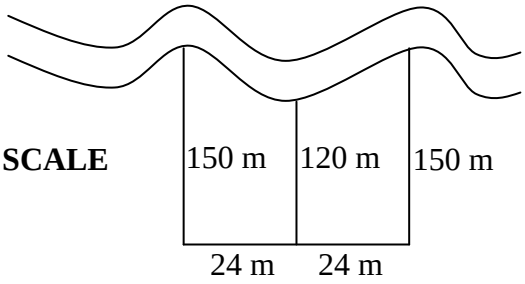
4. A sketch is shown below of a paddock, bordered on one side by a creek. Use Simpson's Rule to find the area of the paddock.

(A) 3 120 m^2.

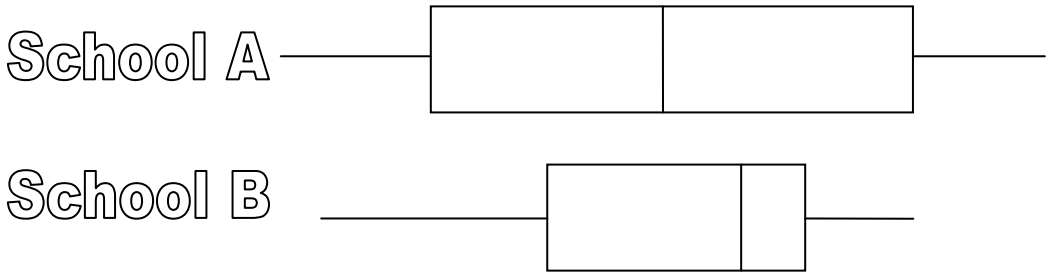
(B) 6 240 m^2.

(C) 26 400 m^2.

(D) 7 200 m^2.



5. The two box and whisker plots below, compare the test results on two schools on the NAPLAN numeracy scale.



Which statement is **not** true?

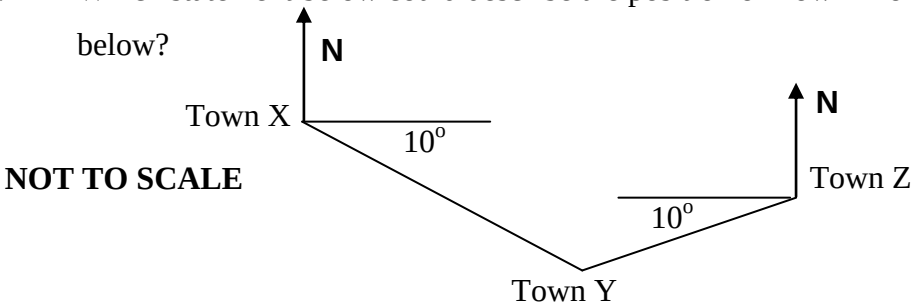
(A) School A had a larger interquartile range.

(B) School A had the higher maximum mark.

(C) School A had the higher median mark.

(D) School A had the lower minimum mark.

6. Which statement below could describe the position of Town Y on the diagram below?



(A) Town Y is on a bearing 100° from X and 260° from Z

(B) Town Y is on a bearing 070° from X and 280° from Z

(C) Town Y is on a bearing 010° from X and 010° from Z

(D) Town Y is on a bearing 100° from X and 270° from Z

7. Andy places 24 chocolates into a bowl, of which 6 are white chocolate, 6 are dark chocolate and 12 are milk chocolate. He takes out two of the dark chocolates and eats them, before offering the bowl to Karen, who picks one chocolate without looking. What is the probability that Karen chose a dark chocolate?

(A) $\frac{1}{4}$ (B) $\frac{1}{6}$

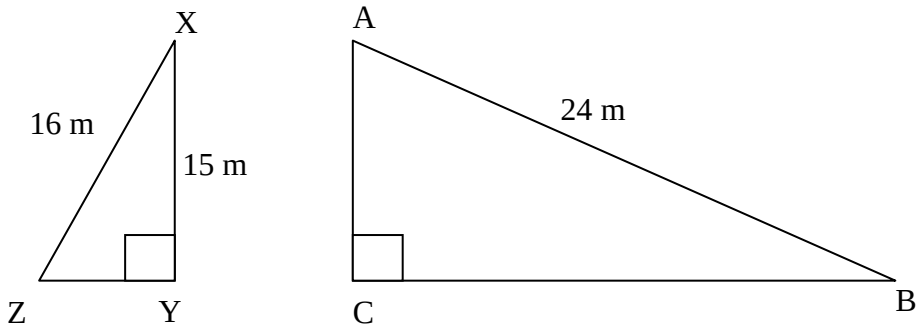
(C) $\frac{3}{11}$ (D) $\frac{2}{11}$

8. Expand and simplify $4y-3(2y-4x)$

(A) $-28y+34x$ (B) $2y+12x$

(C) $-2y+12x$ (D) $-2y-12x$

9. The right triangles ABC and ZXY are similar with angle X equal to angle B. What is the length of CB?



(A) 20 m (B) 25.6 m

(C) 22.5 m (D) 10 m

10. James plays a game involving the tossing of two coins. One turn at this game costs \$1. The possible outcomes are listed below along with their payoffs:

- 2 Heads pays \$5
- 1 Head and 1 Tail pays \$2
- 2 Tails pays nothing.

The financial expectation for this game is:

(A) \$2.25

(B) -\$1.00

(C) \$2.00

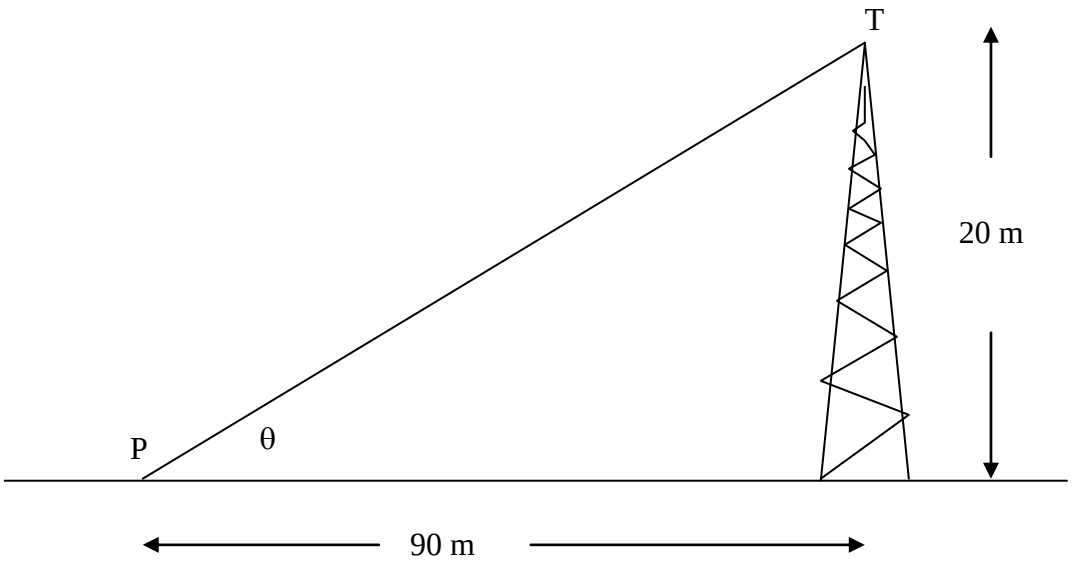
(D) \$1.25

11. Using the formula for velocity $v = \sqrt{u^2 + 2as}$ find the value of v when $u = 10$, $a = 2$ and $s = 11$

(A) $v = 144$ (B) $v = 12$

(C) $v = 16.6$ (D) $v = 66.3$

12. Which calculation could be used to give the angle of elevation (θ), of the top of the tower (T) from the point P?



(A) $\theta = tan^{-1}\left(\frac{90}{20}\right)$ (B) $\theta = sin^{-1}\left(\frac{90}{20}\right)$

(C) $\theta = sin^{-1}\left(\frac{30}{90}\right)$ (D) $\theta = tan^{-1}\left(\frac{20}{90}\right)$

13. Keira invests $2 500 at 6% pa compounding monthly. What is the value of her investment (to the nearest dollar) after 3 years?

(A) $2 538 (B) $2 992

(C) $2 978 (D) $2 950

14. The number of possible arrangements of the letters in the word GENERAL is:

(A) 21 (B) 42

(C) 2520 (D) 5040

15. The altitude of an aeroplane and a weather balloon are compared. The aeroplane's altitude is 4.25 kilometres. The balloon's altitude is 4.3×10^3 metres. What is the difference in their altitudes?

(A) 50 metres (B) 500 metres

(C) 5 metres (D) 0.5 metres

16. Martine buys stationary which costs $104.50 including GST. Because she works for a charity she can claim the 10 % GST back from the taxation office. How much GST can she claim?

(A) $9.50 (B) $10.45

(C) $95.00 (D) $94.05

17. The cost of catering for a party is \$550 for the marquee, staff, tables etc, plus \$25 for each guest for food and consumables. C stands for the cost of the party and N stands for the number of guests. Which equation correctly describes the relationship between C and N ?

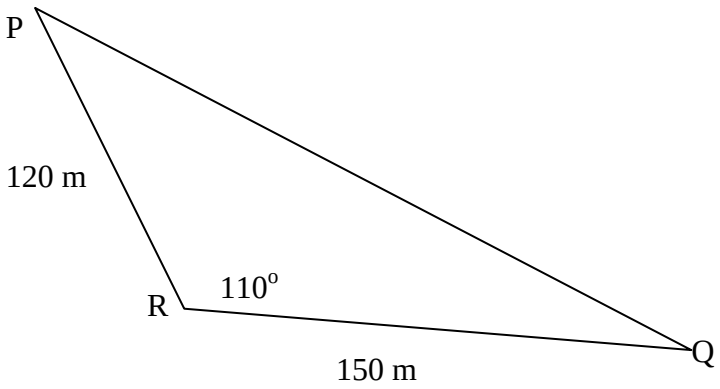
(A) $C = 25N + 550$

(B) $C = 25N - 550$

(C) $C = \frac{N}{25} + 550$

(D) $C = 25(N + 550)$

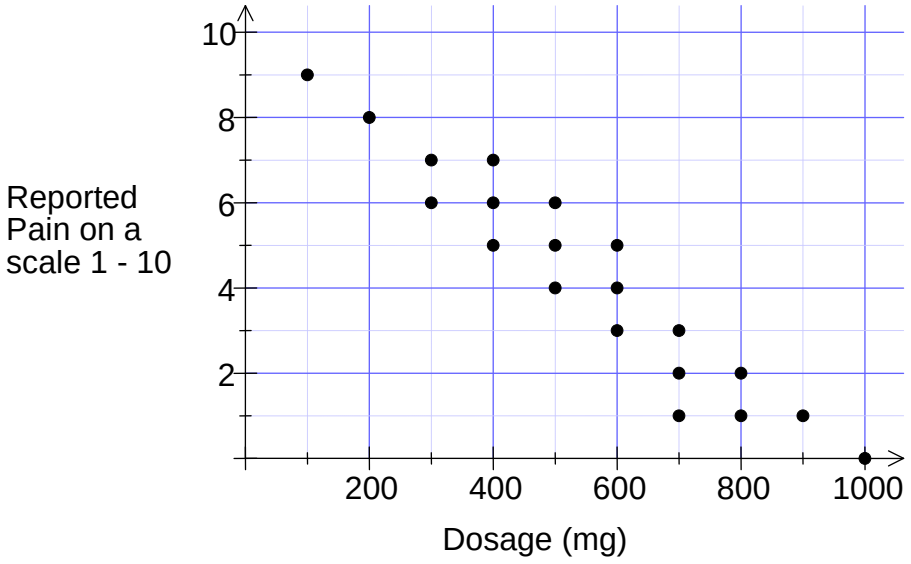
18. What is the length of the side PQ in the triangle below?



(A) 192 m (B) 222 m

(C) 157 m (D) 55 m

19. A scatter plot of pain (as reported by patients) compared to the dosage of a drug is shown below.



How could you describe the correlation between the pain and the dosage?

(A) A strong positive correlation.

(B) A strong negative correlation

(C) A weak positive correlation.

(D) No correlation.

20. Marcus made two errors in his solution to the equation shown below.

$2x+4=5(x-1)$

$2x+4=5x-1$ .....Line 1

$-3x+4=-1$ .....Line 2

$-3x=3$ .....Line 3

$x=-1$ .....Line 4

In which lines did he make his errors?

(A) Lines 1 and 2

(B) Lines 1 and 3

(C) Lines 2 and 3

(D) Lines 2 and 4

21. How much could you save by buying the motorbike below for cash, rather than on the terms advertised?

Redback Motocross Motorbike

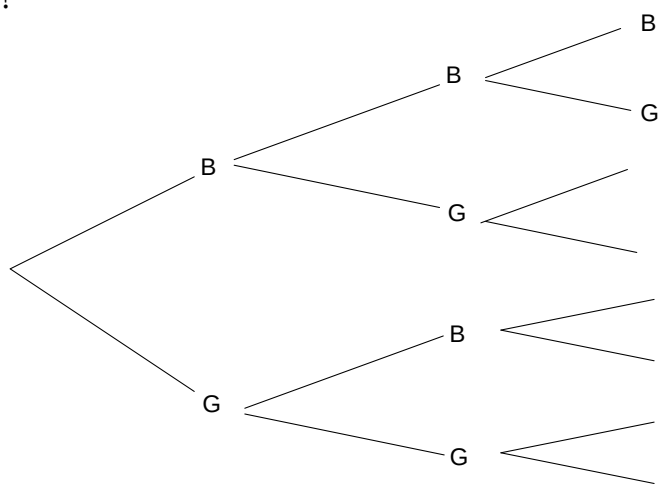
$12 600

Also available on terms of 20% deposit and monthly repayments of $425 over 3 years.

(A) $2 700 (B) $12 900

(C) $5 220 (D) $8 805

22. Jasmin begins a tree diagram to show the gender outcomes for a three child family. What is the probability that the first and last child will be different genders?



(A) $\frac{3}{8}$ (B) $\frac{1}{4}$

(C) $\frac{5}{8}$ (D) $\frac{1}{2}$

End of Section 1

Section II

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

Answer all questions, starting each question on a new sheet of paper with your name and question number at the top of the page. Do not write on the back of sheets.

Question 23 (13 marks) Start a new sheet of paper. **Marks**

a) A study of the effectiveness of a drug to reduce blood pressure produced the results below.

	Reduced Blood Pressure	**Did not Reduce Blood Pressure**	**Totals**
Had Side effects	15	**X**	23
Had No Side Effects	50	7	57
Totals	65	15	**Y**

(i) What number should be written in the position marked **Y** in the table? **1**

(ii) What number should be written in the position marked **X** in the table? **1**

(iii) What percentage of people had reduced blood pressure with no side effects? **2**

b) Saskia is employed at the cinema under the conditions outlined below.

- Normal rate : $7.50 / hour for up to eight hours.
- Time and a half for the first 2 hours overtime then double time after that.
- Triple time for public holidays.

(i) What would she earn for 8 hours work on a public holiday? **1**

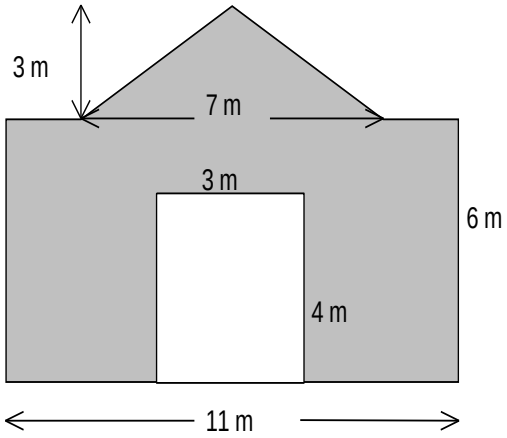
(ii) What would she earn for 12 hours work on a normal working day? **2**

Question 23 continues

c) Solve the equation below, showing all working. **3**

$\sqrt{2x+5} = 10$

d) A shed has a front elevation as shown below. The shed has an open doorway.



Not to scale

(i) What area of sheet metal would be required to clad the front of the shed? **2**

(ii) The shed is in the shape of a prism which is 15 m deep. What is the total volume of the shed? **1**

End of Question 23

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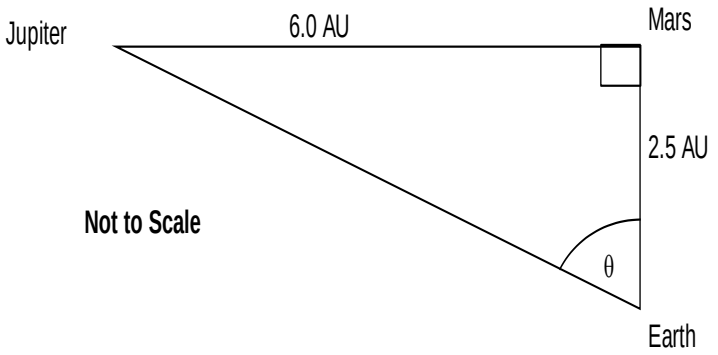
Question 24 (13 marks) Start a new sheet of paper.

Marks

a) At a certain time, three planets are located at the corners of a right triangle, as shown in the diagram below. The distances between them are in Astronomical units (AU).

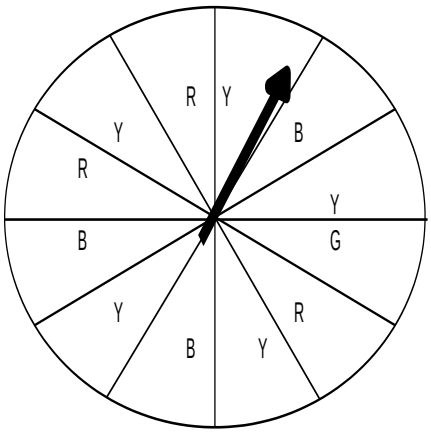


(i) If 1 AU = 150 000 000 km , how many kilometres is Earth from Mars at this time, correct to 2 significant figures? **1**

(ii) Express the distance between Jupiter and Mars in kilometres, expressed in Scientific notation. **1**

(iii) Calculate the distance in AU between Jupiter and Earth. **1**

b) A spinner in a game has 12 equal sized sectors which are coloured Blue(B), Red (R) Green (G) or Yellow (Y) as shown in the diagram. It is spun a single time.



(i) What colour is the spinner most likely to land on? **1**

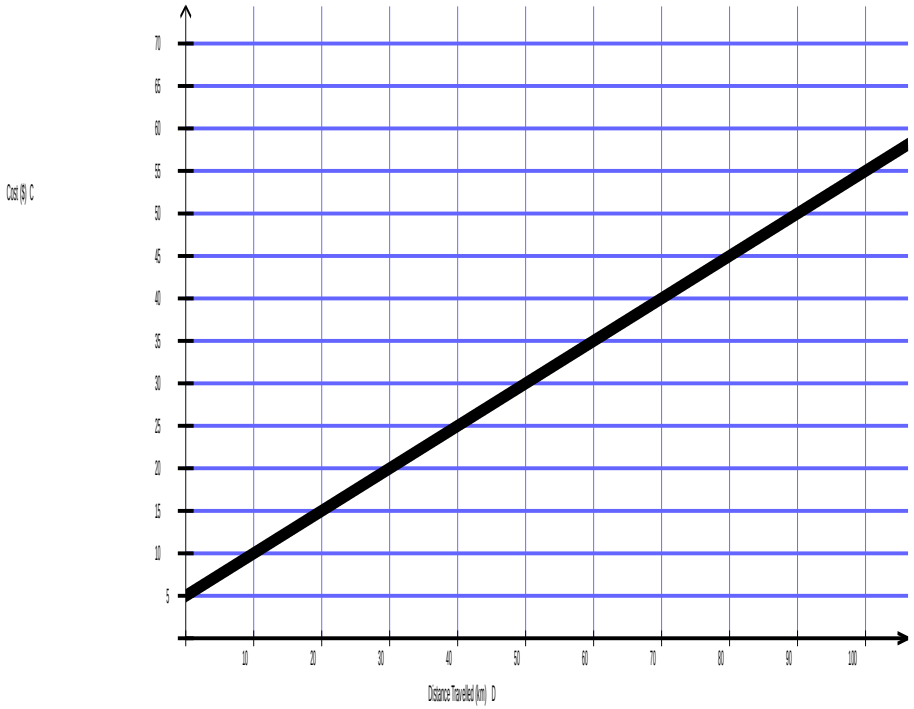
(ii) Which colours are equally likely? **1**

(iii) What is the probability the spinner will not land on a green sector? **1**

Question 24 continues

Question 24 continued **Marks**

c) The cost of travelling by taxi is shown on the graph below.



(i) What is the cost per kilometre of travelling by taxi? **2**

(ii) Using C for cost and D for distance, write an equation that describes the line graph for the cost of hiring a taxi. **2**

d) The table below shows the results of a phone survey of the voting intentions of 200 people chosen from the local phone book.

	Male	**Female**	**Total**
Liberal	40	17	57
Labor	45	16	61
Other	70	12	82
Total	155	45	200

(i) What percentage of females said they would vote Labor (to the nearest whole number)? **1**

(ii) What is the ratio of Liberal to Labor voters among the males, in simplest form? **1**

(iii) This poll is not a good random sample of the voting population. Outline one reason for this. **1**

End of Question 24

Question 25 (13 marks) Start a new sheet of paper. **Marks**

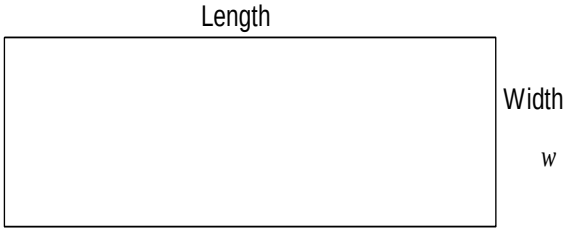
a) The table below gives the value of $1.00 after being invested at different rates of compound interest for varying terms.

	Compound interest rate pa						
Years Invested	**2%**	**3%**	**4%**	**5%**	**6%**	**7%**	**8%**
1	$1.0200	$1.0300	$1.0400	$1.0500	$1.0600	$1.0700	$1.0800
2	$1.0404	$1.0609	$1.0816	$1.1025	$1.1236	$1.1449	$1.1664
3	$1.0612	$1.0927	$1.1249	$1.1576	$1.1910	$1.2250	$1.2597
4	$1.0824	$1.1255	$1.1699	$1.2155	$1.2625	$1.3108	$1.3605
5	$1.1041	$1.1593	$1.2167	$1.2763	$1.3382	$1.4026	$1.4693
6	$1.1262	$1.1941	$1.2653	$1.3401	$1.4185	$1.5007	$1.5869
7	$1.1487	$1.2299	$1.3159	$1.4071	$1.5036	$1.6058	$1.7138
8	$1.1717	$1.2668	$1.3686	$1.4775	$1.5938	$1.7182	$1.8509
9	$1.1951	$1.3048	$1.4233	$1.5513	$1.6895	$1.8385	$1.9990
10	$1.2190	$1.3439	$1.4802	$1.6289	$1.7908	$1.9672	$2.1589

(i) What would be the value of an investment of $ 20 000 invested at 6% pa for 9 years? **1**

(ii) Joseph has $20 000 to invest for 5 years. He wants his investment to be worth at least $25 500 after this time. What is the lowest interest rate he could choose? **2**

b) A rectangular garden bed is to be constructed so that its length is 4 metres more than twice its width.



(i) Give a possible set of dimensions (length and width) for the garden bed. **1**

(ii) If the width is denoted by w, write an expression for the length of the garden bed. **1**

(iii) Write an equation for the area of the garden bed (A) in terms of w. **1**

Question 25 continues

Question 25 continued

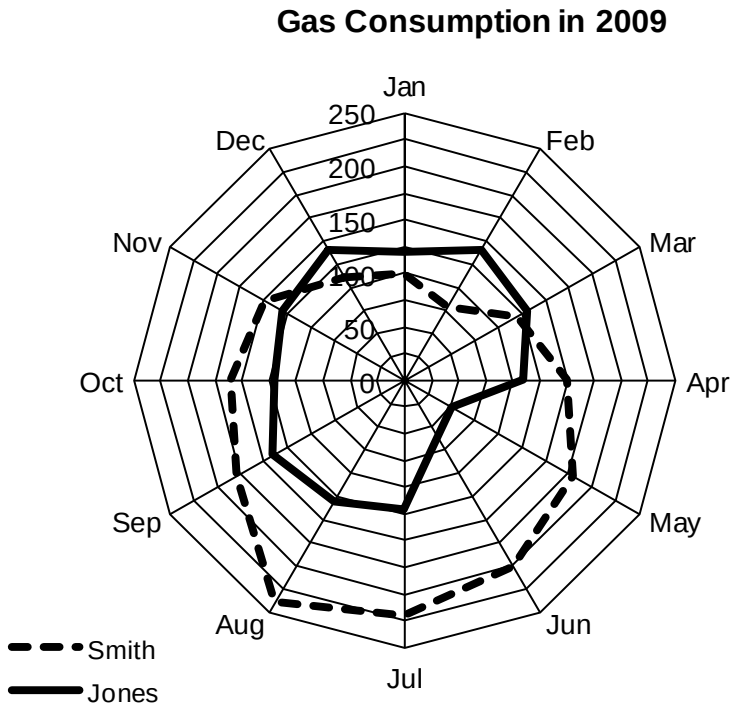
Marks

c) Andy, Roger, Leyton and Jo turn up for tennis practice.

(i) How many games will be played if every player is to play a practice game against each of the others? **1**

(ii) If all games are arranged randomly, what is the probability that Andy will play Leyton, then Jo, then Roger, in that order? **2**

d) The radar chart below compares the usage of Natural Gas by two families over a year.



(i) One family used Gas for cooking and heating and the other for cooking only. Determine which family used gas for heating and explain your choice. **1**

(ii) The Jones family went away for six weeks during the year. During which months was this? **1**

(iii) The Smith family had a larger mean and larger standard deviation for their monthly gas usage than the Jones family. Using the information on the graph explain why the Smith families results are the larger for these two measures. **2**

End of Question 25

Question 26 (13 marks) Start a new sheet of paper.

Marks

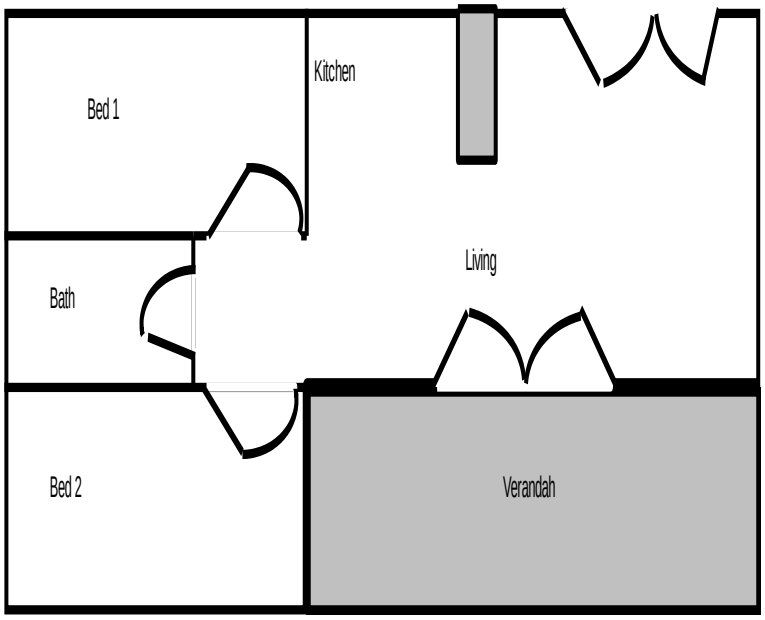
a) Justin is a salaried worker whose taxable income for the year is $41 688.

(i) Calculate the tax payable on his taxable income, using the table below. **2**

Taxable income	*Tax on this income*
$1 – $6,000	Nil
$6,001 – $35,000	15c for each $1 over $6,000
$35,001 – $80,000	$4,350 plus 30c for each $1 over $35,000
$80,001 – $180,000	$17,850 plus 38c for each $1 over $80,000
$180,001 and over	$55,850 plus 45c for each $1 over $180,000

(ii) If he had PAYG tax instalments of 135.00 per week taken from his pay, calculate the refund that he is due at the end of the financial year. **1**

b) The diagram below shows the plan of a two bedroom cottage. **2**

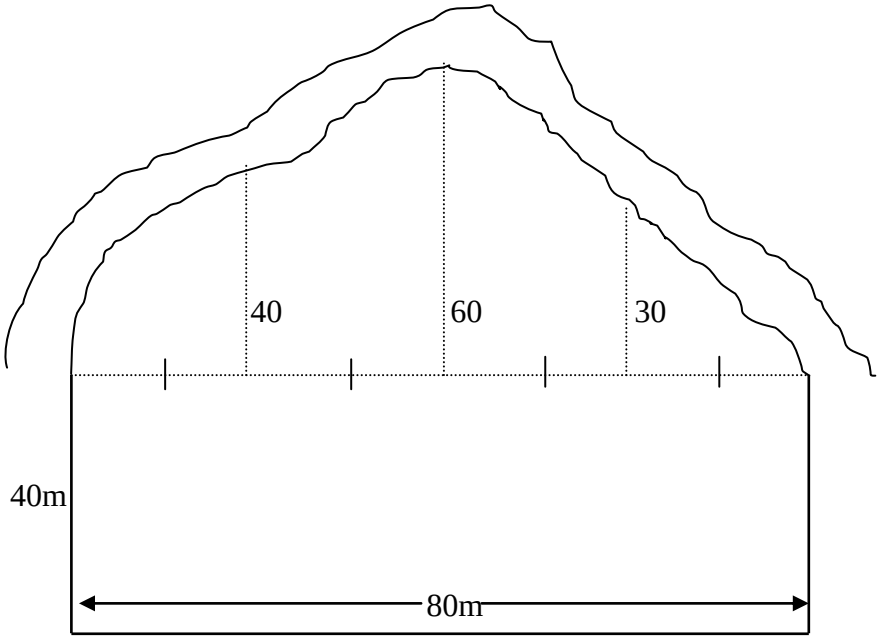


What is the area of the verandah of the cottage?

Question 26 continues

Question 26 continued **Marks**

c) A Diagram of Mr Smith's paddock is shown below. It is bounded by three fences and a river as illustrated below.



(i) Use two applications of Simpson's rule and other methods to calculate the area of the paddock. **3**

(ii) If the paddock is to have top soil laid to a depth of 20cm, over it's entire area. What is the volume of top-soil required? **1**

d) Heather, who lives at Broken Hill, looks up the latitude and longitude information shown in the table below.

Location	Latitude	Longitude
Broken Hill (NSW)	32^o S	141^o E
Glasgow (UK)	56^o N	4^o W
Sapporo (Japan)	43^o N	141^o E

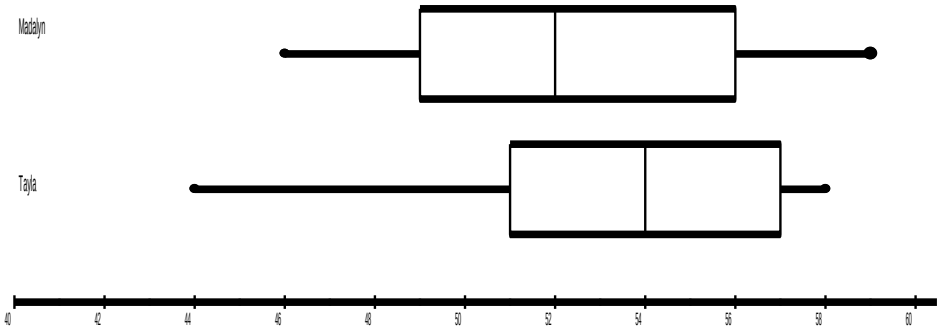
(i) Heather has an internet pen friend in Sapporo, Japan. What is the angular distance between their home towns? **1**

(ii) Given that 1^o subtends 60 nautical miles and that 1 nautical mile = 1.852 km, how many kilometres apart are their home towns? **1**

(iii) Heather has another pen friend in Glasgow, UK. What is the time in Glasgow when Heather sends her penfriend an email at 10 pm on Tuesday night local time in Broken Hill? **2**

Question 27 (13 marks) Start a new sheet of paper. **Marks**

a) The box and whisker plots shown below, compare the results of two archers on a competition in which they each have completed 50 ends.



(i) Who scored the highest individual score and what was that score? **1**

(ii) What was the difference in their median scores? **1**

(iii) Who has the greater interquartile range, and by how much was it greater? **2**

b) Connie buys a computer, valued at $3 400 for her business. She compares the methods she can use to depreciate the computer for tax purposes.

(i) Using the straight line method, she can depreciate the computer by $320 per year. What would be the value of the computer after 3 years using this method? **1**

(ii) How many whole years would it take for the value to drop below $1000 using this method? **1**

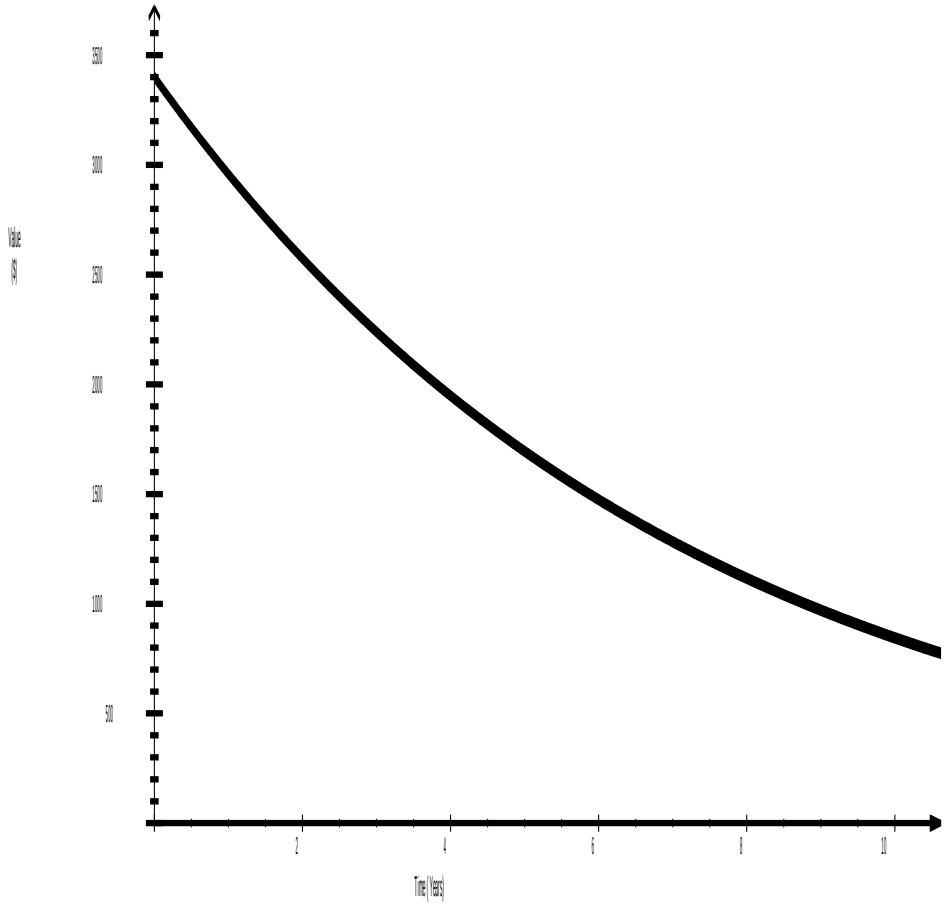
(iii) Using the declining balance method, she can depreciate the computer by13% pa. Calculate the value of the computer after 3 years using this method? **1**

Question 27 continues

Question 27 continued **Marks**

(iv) Connie graphed the value under the declining balance method. The result is shown below. Use the graph to estimate how many whole years it would take for the value to drop below $1 000, using this method. **1**

Use graph at end of paper and handed in with your answers.



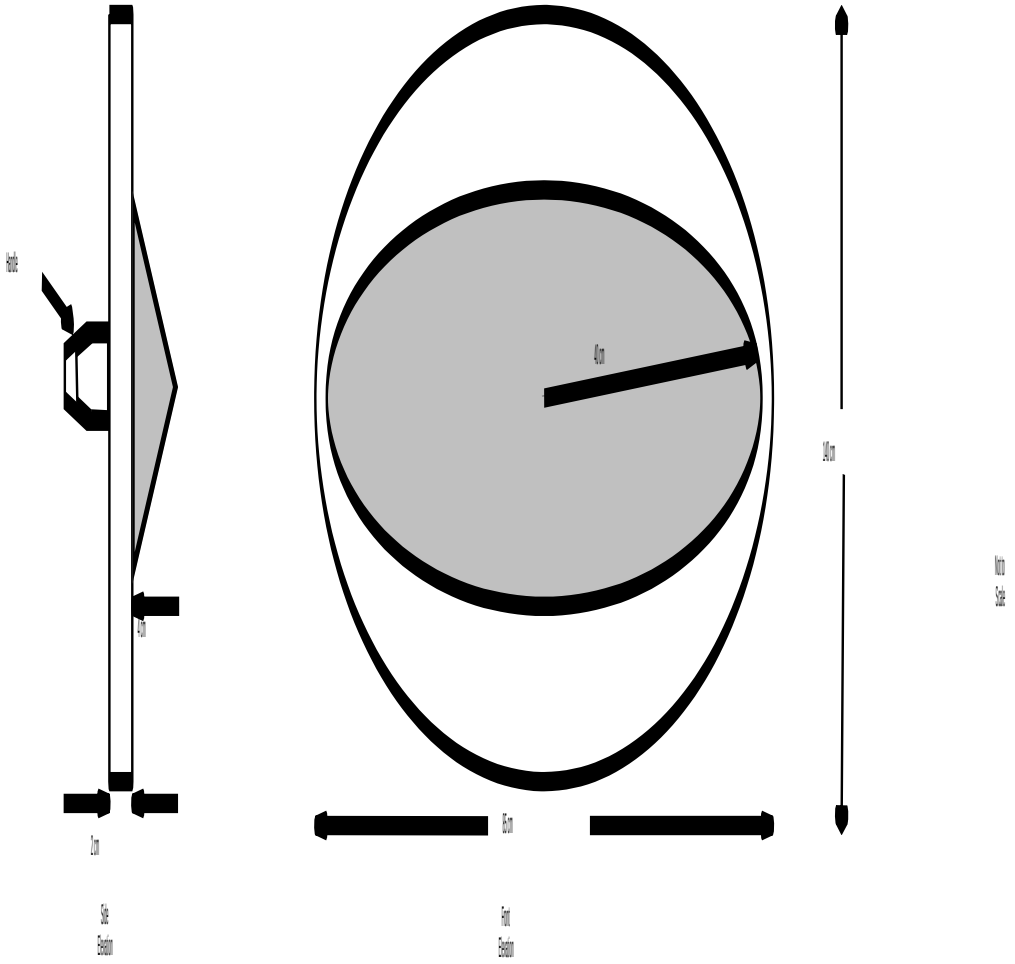
(v) Using the graph, or otherwise, estimate after how many years the two methods would give the same depreciated value of the computer, and it's approximate value at this time. **2**

Question 27 continues

Question 27 continued

Marks

c) A shield used in a school play is an elliptical prism 2 cm thick with dimensions as shown in the diagram below. It has a raised cone on its face which has a radius of 40 cm and height of 4 cm.



(i) If the handle has a volume of 25 cm^3, and the shield is completely solid, what is the total volume of the shield, including the handle? **2**

(ii) The shield is made of plastic which weighs 0.2g/cm^3, what is the weight (in kilograms) of the shield? **1**

End of Question 27

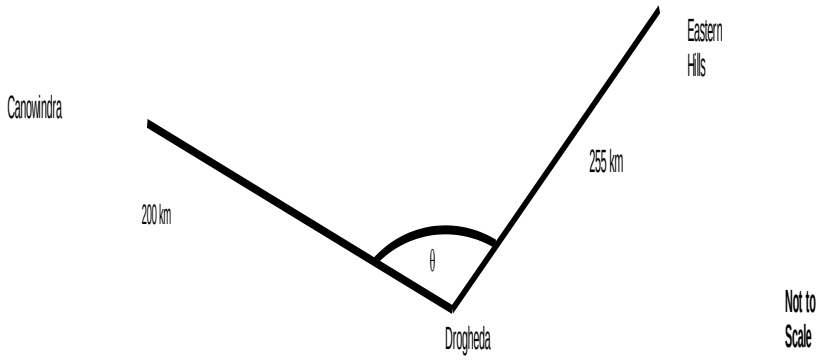
Question 28 (13 marks) Start a new sheet of paper. **Marks**

a) Starting in January 2010, Wendy invests $250 at the end of each month, into an account which pays 6% pa interest, compounding monthly.

(i) What amount would be in her account after 2 years? **1**

(ii) She wishes to buy a car with the money in the account when it reaches $20 000. How many years and months will this take? **2**

b) Imran flies his light plane from Canowindra for 200 km on a bearing 115^o to "Drogheda" property, where he picks up Kevin and flies him 255 km on a bearing 042^o to "Eastern Hills" station. Some of the information is shown on the diagram below.



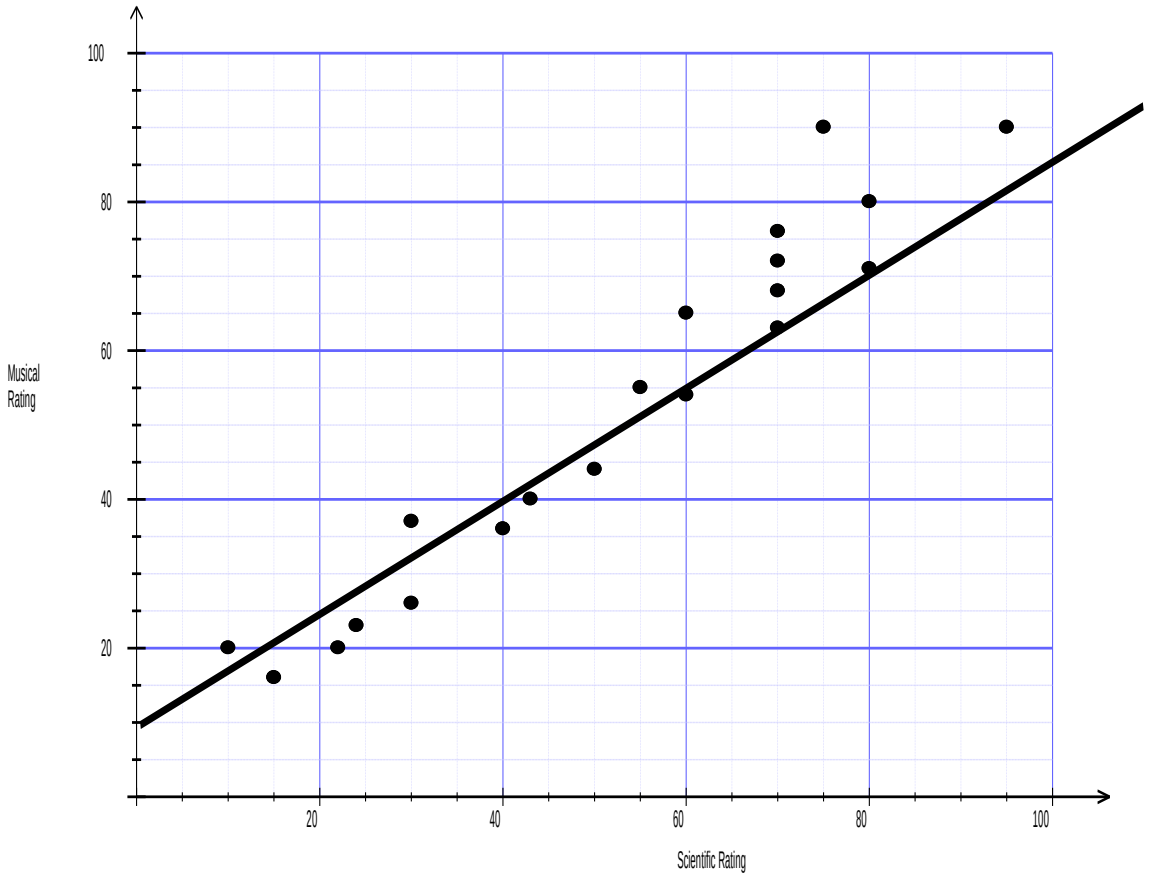
(i) Copy the diagram and use it to explain why the angle marked θ is 107^o. **1**

(ii) Calculate the distance from Canowindra to "Eastern Hills" in a straight line. **3**

Question 28 continues

Question 28 continued **Marks**

c) Regina is doing research on the relationship between musical and scientific ability. She tested 20 students on both skills and graphed the results on a scatterplot, then drew a line of best fit.



(i) Explain why the line Regina drew is **not** a median regression line. **1**

(ii) Give the equation of the line that Regina drew. **2**

d) In a game two coins are tossed. A player outlays $10 and if both coins show heads the player is paid $16, if they both show tails the player is paid $20.

(i) What is the probability that two heads will show? **1**

(ii) Calculate the expected return from $100 spent playing this game. **2**

End of Examination

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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

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

θ = number of degrees in central angle

Arc length of a circle

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

θ = number of degrees in central angle

Simpson's rule for area approximation

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

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

Cylinder $V = \pi r^2 h$

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

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

r = radius
h = perpendicular height
A = area of base

Sine rule

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

Area of a triangle

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

Cosine rule

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

or

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

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–inte cept 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:

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

Trial HSC Examination – General Mathematics 2012

Multiple Choice Answer Sheet

Name _____ Number_____

Completely fill the response oval representing the most correct answer.

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 ⬭