

Section 2

Question 1. (3, 1, 2, 2 marks)

A shopping centre conducts a survey of 400 shoppers on their preference for 24 hour shopping. Responses were recorded as 'Yes', 'No' or 'Undecided'

The shoppers were broken into 3 age groups: Group 1: under 25 years old, Group 2: 26 – 40 years old and Group 3: over 40 years old.

35 Group 1 answered Yes, 47 Group 2 answered No, 53 Group 3 were Undecided. There were 109 participants in Group 2 and a total of 143 answered Yes. Of the 102 Undecided 32 were from Group 1. The same number said No in Group 1 as in Group 3.

	Group 1	Group 2	Group 3	Total
Yes	35	45	63	143
No	54	47	54	155
Undecided	32	17	53	102
Total	121	109	170	400

(a) Complete the table using the information given.

(b)

If a person is chosen from random from one of the groups what is the probability that they were from Group 2 and responded Yes?

$$\frac{45}{400}$$

✓

f/t

(d)

What is the probability that a person chosen is Undecided given that he belongs to Group 1?

$$\frac{32}{121}$$

✓

(a)

Given that the person answered Yes what is the probability that he belonged to Group 3?

$$\frac{63}{143}$$

✓

Question 2. (2, 3, 2 marks)

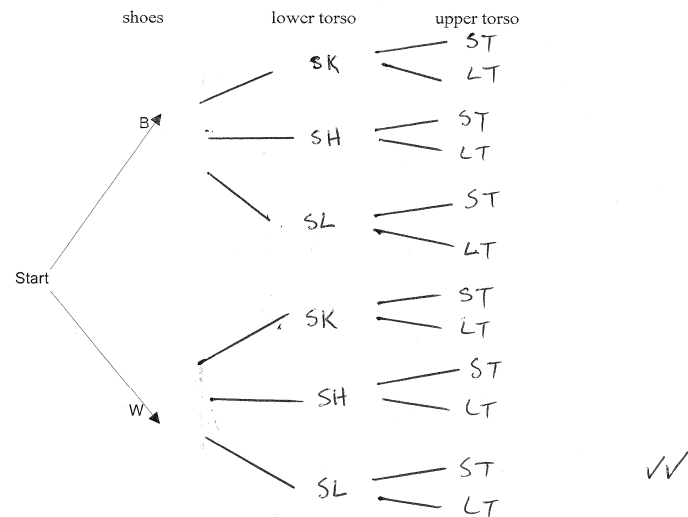
At Metropolitan SHS, year 12 girls have to wear school uniform.

For footwear, they have a choice of black shoes or white shoes. [B or W]

On their lower torsos, they have a choice of skirt, shorts or slacks. [SK, SH or SL]

On their upper torsos, they have a choice of standard top or leavers' top. [ST or LT]

(a) In the space below, complete the tree diagram to show all possible combinations.



- (b) If a year 12 girl is equally likely to choose any of these combinations, what is the probability she chooses

$$\frac{4}{12} = \frac{1}{3} \quad \checkmark$$

- (i) a skirt?

$$\frac{2}{12} = \frac{1}{6} \checkmark$$

- (ii) a skirt and a leavers' top

$$\underline{\frac{8}{12} = \frac{2}{3}} \quad \checkmark$$

- (iii) a skirt or a leavers' top

- (c) Sally is fashion conscious and will not wear black shoes if she wears her leavers' top. If she is equally likely to choose any other combination, what is the probability that she wears shorts and white shoes?

$$\frac{2\checkmark}{9\checkmark}$$

Question 3: (1, 1, 1 marks)

Shaggy keeps his textbooks on a shelf above his desk. He has 3 Math books, 2 English books, 2 Science books and 1 Geography book. How many ways of arranging his books are possible if,

(a) he does not mind the order?  $8! = 40320$  ✓

(b) the Math books must be kept together?  $6! 3! = 4320$  ✓

(c) the books are to be kept in subject from left to right, Math, Science, English and then Geography  $3! \times 2 \times 2 \times 1 = 24$  ✓

(d) each subject is kept together?

$$3! \times 2 \times 2 \times 1 \times 4! = 576 \quad \checkmark$$

Question 4: (2 marks)

Sandra is studying the number of quokkas found on Bald Island near Albany. To approximate the island population Sandra tagged a group of 25 quokkas with small markings. Six weeks later, Sandra captured 56 quokkas, of which 4 had the same small markings. Estimate the total population of quokkas on the island. Show all working.

$$\frac{\text{tagged in sample}}{\text{total in sample}} = \frac{\text{tagged in pop'n}}{\text{total in pop'n}}$$

$$\frac{56}{4}$$

$$= \frac{x}{25}$$

$$\frac{x}{25} = \frac{56}{4}$$

$$\checkmark \quad x = 350$$

Approx 350 Quokkas

Question 5. (1, 1, 1, 1, 1. marks)

The following are heights of school children recorded to the nearest 5 cms.

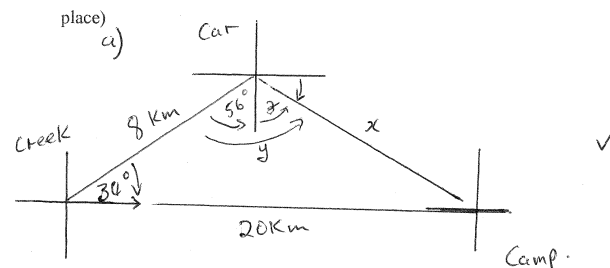
Height(cms)	Frequency
$145 \leq x < 150$	11
$150 \leq x < 155$	16
$155 \leq x < 160$	27
$160 \leq x < 165$	22
$165 \leq x < 170$	16
$170 \leq x < 175$	12
$175 \leq x < 180$	9
$180 \leq x < 185$	8

- (a) Which is the modal class of the data?  $155 \leq x < 160$  cm ✓  
 ↳ must be class
- (b) Determine: (2dp)
- (i) the mean  $162.79$  cm ✓  
 ↓
- (ii) the standard deviation  $9.78$  cm ✓  
 (-1 overall if not 2dp)
- (iii) in which group does the median lie?  $160 \leq x < 165$  cm ✓
- (c) A basketball coach is looking for players at least 175cm tall. What percentage of players would qualify for the basketball team?

$$\frac{17}{121} \times 100 = 14\% \quad \checkmark$$

Question 15. (15 marks)

A man walks a distance of 8 km in a direction  $S56^\circ W$  from his car to a creek. He then walks 20 km due East from the creek to a camp. What is the bearing of the camp from the man's car? (to 1 decimal place)



b)

$$x^2 = 8^2 + 20^2 - 2 \times 8 \times 20 \times \cos 34^\circ \quad \checkmark$$

$$x \approx 14.1 \text{ km.} \quad \checkmark$$

∴ Distance is 14.1 km

$$\frac{\sin y}{20} = \frac{\sin 34}{14.1} \quad \checkmark$$

$$y \approx 52.5^\circ \text{ or } 127.5^\circ, \text{ note } 52.5^\circ \text{ not possible.}$$

$$z \approx 127.5 - 5.6 \approx 71.5^\circ \quad \checkmark$$

(ignore if not mentioned)  
no mark deduction.

End of Part B

The bearing is  $S.71.5^\circ E.$  ✓

Question 14. (2, 2, 2 marks)

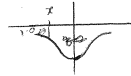
Flour from a mill is poured in '1 kg' bags for sale to the public. In fact, the weight of flour in the bags is normally distributed with a mean of 1005 g and a standard deviation of 4 g.

(a) What is the probability that a randomly selected bag of flour is under the market weight?

$$P(X < 1000) = 0.1056 \quad \checkmark$$

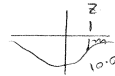


(b) What is the weight that is exceeded by only 10 % of the bags?



$$1010.13g \quad \checkmark$$

(c) The mill owners decide that no more than 1 % of the bags should be underweight. They increase the mean weight of the bags without changing the standard deviation. What should be the mean weight of the flour (to the nearest 0.1g) to ensure that no more than 1 % of bags are underweight?



$$P(X < 2) = 0.01$$

$$z = -2.326 \quad \checkmark$$

$$\frac{4}{1000 - \bar{x}} = -2.326$$

$$\bar{x} = 1009.3g \quad \checkmark$$

(-1 overall no units)

Question 6. (2, 2, marks)

A National Wildlife Park notices that the population of native deer in the year 2000 was increasing according to the equation  $y = \frac{10}{n(n+20)} + 30$  whilst the population of feral dogs in the same Park was increasing according to the equation  $y = 10(1.1)^n$  where  $n$  is the number of years after 2000. Use your CAS calculator to answer the following questions.

- (a) How many
- (i) native deer were there in 2000? 30 ✓
- (ii) feral dogs were there in 2000? 10

(b) In which year and month will the two populations equal each other if these rates of increase are maintained?

During Aug 2030 ✓

$n \approx 30.6 \approx 31$

$0.6076 \times 12 = 7.29$  months

( $\frac{1}{2}$  of 30 yrs and 7 months)

Question 7. (2, 2 marks)

(a)  $P$  is directly proportional to the cube of  $y$ . If  $P = 40$  when  $y = 2$ . Find:

(i)  $P$  in terms of  $y$ .

$$P = ky^3$$

$$40 = k \times 2^3$$

$$k = 5$$

$$\therefore P = 5y^3 \quad \checkmark$$

(ii)

$y$  when  $P = 20$  (correct to 2 decimal places).

$$P = 5y^3$$

$$20 = 5y^3$$

$$y^3 = 4$$

$$y = \sqrt[3]{4} \approx 1.59 \quad \checkmark$$

(b) Under certain circumstances, the volume  $V$  (mL) of a given quantity of gas is inversely

proportional to its pressure  $P$  (kPa) as given by the equation  $V = \frac{c}{P}$  where  $c$  is a positive constant. In a particular experiment, when the pressure was 90 kPa, the volume of gas was

40mL. What will the pressure be when the pressure is increase to 120 kPa?

$$V = \frac{P}{c}$$

$$40 = \frac{90}{c}$$

$$c = 3600$$

$$\therefore V = \frac{P}{3600}$$

$$V = \frac{P}{3600}$$

$$= \frac{120}{3600}$$

$$V = 30 \quad \checkmark$$

$$V = 30 \text{ mL} \quad \checkmark$$

Question 8 (3, 3 marks)

The equations for the following graphs are (not necessarily in order): -

$$2y + x = 2$$

$$y = (x - 1)^3 - 2$$

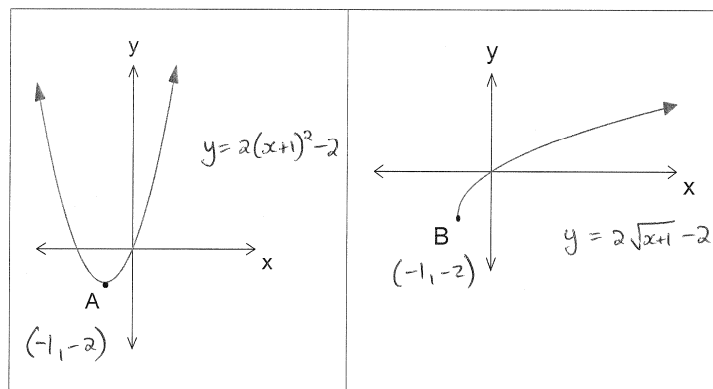
$$y = 2(x + 1)^2 - 2$$

$$y = \frac{2}{x - 2}$$

$$y = 2(x - 1)^2(x - 2)$$

$$y = 2\sqrt{x + 1} - 2$$

- (a) Write the equation which matches the graph in the appropriate cell.  
 (b) Next to each of the points A to I, write its coordinates.



Question 13. (3, 2, 2 marks)

A mathematics exam is marked out of 150 and the class mean for 25 students is 92 with a standard deviation of 12.3. The lower quartile is 74 and the upper quartile is 112.

- (a) The top mark is 147 while the bottom mark is 11.  
 One definition of an outlier is a score that lies more than  $1.5 \times$  the interquartile range above the upper quartile or below the lower quartile.  
 Determine if either of the 2 marks is an outlier by this definition

$$IQR = 112 - 74 = 38$$

$$1.5 \times 38 = 57 \quad \checkmark$$

$$\begin{aligned} UQ + 57 &= 169 \quad \checkmark \\ LQ - 57 &= 17 \quad \checkmark \end{aligned}$$

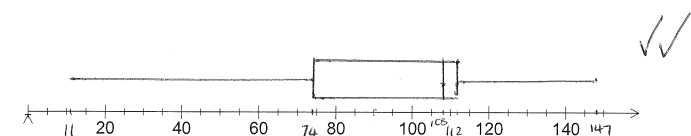
11 is an outlier  $\checkmark$

- (b) A student who is away for the exam does it at a later date and scores 134. Calculate the new class mean.  

$$25 \times 92 + 134 = 2434 \quad \checkmark$$

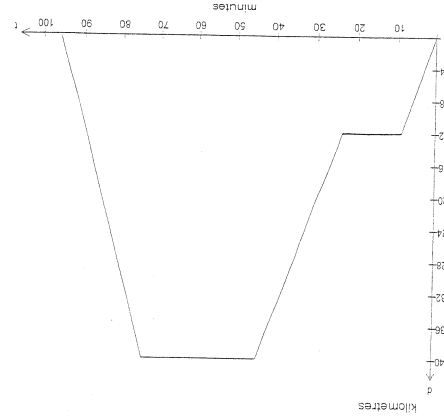
$$\bar{x} = 2434 \div 26$$

$$= 93.6 \quad \checkmark$$
- (c) If the median of the original dataset is 108 draw a boxplot of the dataset on the axes below.



Question 12. (1, 2 marks)

Belle needs to go to hospital to visit her Grandma. She drives her car 12 km to the nearest florist, which takes her 9 minutes to get there. It took her 15 minutes to select the flowers and write the card. She then drove another 28 km to get to the hospital, which took her 20 minutes. She spent half an hour with her Grandma and then went straight home. This final journey from hospital to home, took her 22 minutes. The graph of her journey is drawn below.



(a) What was the total distance that Belle travelled?

80km ✓

(b) Express her speed for the first 9 minutes of the journey in:

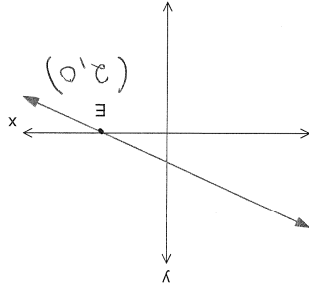
(i) km/h

12km/9min  
120km/90min ✓  
80km/hr

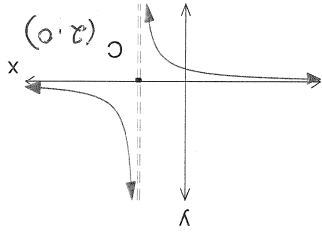
(ii) m/s

12km/9min  
12000m/9min  
1333.3m/min  
22.2m/s ✓

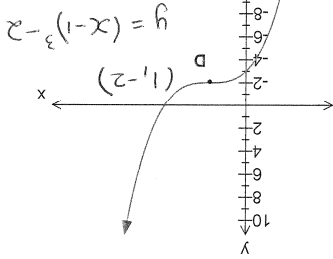
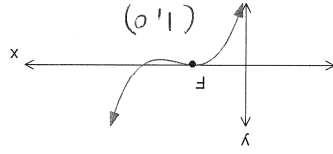
$$2y + x = 2$$



$$y = \frac{x-2}{2}$$



$$y = 2(x-1)^2(x-2)$$



Question 9 (2, 1, 2 marks)

The value of a certain stock changes daily. On odd numbered days of the month it increases by 10%, and on even numbered days of the month it decreases by 10%.

- (a) By what percentage increase or decrease will the value of the stock change over two consecutive days?

$$100\% \times 1.1 \times 0.9 = 99\%$$

∴ decrease by 1% ✓

- (b) At the beginning of November 1<sup>st</sup> the value of the stock is \$50 000. What will be the value at November 30<sup>th</sup>?

$$50\,000 \times 1.1^{15} \times 0.9^{15}$$

$$= \$43\,002.90$$

- (c) Is there any month(s) in which the value of the stock increases? Justify your answer.

$$100\% \times 1.1^{16} \times 0.9^{15} = 94.6\%$$

✓ No because even when there is an odd number of days in the month to stock still decreases.

Question 10 (2, 1, 2 marks)

A man borrows \$20 000 at 10% p.a. compound interest paid annually and agrees to repay at a rate of \$3 000 per year.

- (a) How much does he still owe at the end of 10 years?

$$\$4062.58 \quad \checkmark \checkmark$$

After 10 years the lender increases the interest rate to 11% but agrees that the repayments remain the same.

- (b) During which year will the man finish repaying his loan?

$$10 + 1.5 = 11.5 \text{ years}$$

During the 12<sup>th</sup>. ✓

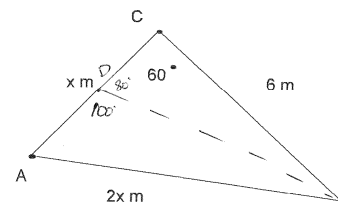
- (c) What amount is his final repayment?

$$1509.46 \times 1.11$$

$$= \$1675.50 \quad \checkmark \checkmark$$

Question 11. (3, 3 marks)

Consider the triangle drawn below.



- (a) Show that  $3x^2 + 6x - 36 = 0$

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

$$(2x)^2 = 6^2 + x^2 - 2 \times 6 \times x \cos 60^\circ \quad \checkmark$$

$$4x^2 = 36 + x^2 - 2 \times 6 \times x \times \frac{1}{2} \quad \checkmark$$

$$3x^2 = 36 - 6x$$

$$\therefore 3x^2 + 6x - 36 = 0. \quad \checkmark$$

- (b) D is a point on the line AC such that the angle ADB = 100°. Calculate the length of BD. Working...

In  $\triangle CDB$

$$\checkmark \frac{BD}{\sin 60^\circ} = \frac{6}{\sin 80^\circ} \quad \checkmark$$

$$BD = \frac{6}{\sin 80^\circ} \times \sin 60^\circ$$

$$\approx 5.3 \text{ m. } \checkmark$$