Section I

22 marks
Attempt Questions 1 - 22
Allow about 25 minutes for this section

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

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1 If a pieceworker earns x cents per article for up to 100 articles and y cents per article thereafter, then his total earnings in dollars for producing 119 articles is

(A) $100x+19y$

(B) $100y+19x$

(C) $\dfrac{100x+19y}{100}$

(D) $\dfrac{19x+100y}{100}$

2 The diameter of a human hair is 0.0000456mm. In scientific notation this is equal to:

(A) 4.56×10^{-4}

(B) 4.56×10^{-5}

(C) 4.56×10^{4}

(D) 4.56×10^{5}

3 A fruit punch juice is to be made for a party. It consists of orange juice, apple juice and pineapple juice in the ratio of 2:2:1. If we want to fill a 9 litre bucket with the punch, how much pineapple juice will be needed?

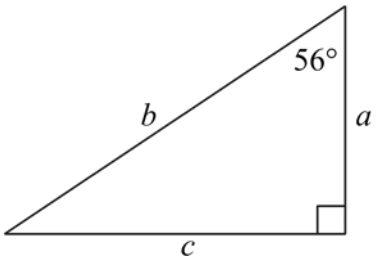
(A) 3.6 L

(B) 2.7 L

(C) 0.9 L

(D) 1.8 L

4 What is the correct expression for tan56° in this triangle?



Not to scale

(A) $\dfrac{a}{b}$

(B) $\dfrac{a}{c}$

(C) $\dfrac{c}{b}$

(D) $\dfrac{c}{a}$

5 What is the correct way of writing the number 305.725 to 2 significant figures?

(A) 310

(B) 306

(C) 300

(D) 305.73

6 Addison earned $1071 last week. He worked 36 hours at the normal rate and 4 hours at the time-and-a-half rate. What is Addison's normal rate of pay?

(A) $24.34

(B) $25.50

(C) $26.78

(D) $29.75

7 The following frequency table shows Poppy's scores on a number of tests.

Score	Frequency
1	1
2	3
3	6
4	2
5	1

Which expression gives Poppy's mean score?

(A) $\frac{1+6+18+8+5}{13}$

(B) $\frac{1+6+18+8+5}{5}$

(C) $\frac{1+2+3+4+5}{13}$

(D) $\frac{1+2+3+4+5}{13}$

8 A bottle of soft drink costs $2.50. If the inflation rate is predicted to average 2% for the next five years, the cost of the soft drink in five years will be:

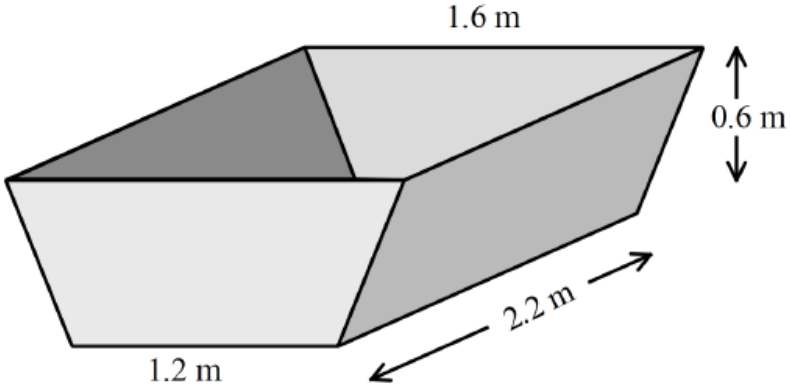
(A) $2.60

(B) $2.70

(C) $2.75

(D) $2.76

9 A drinking trough for animals is in the shape of a trapezoidal prism, with the dimensions shown. When completely full, what is its capacity?

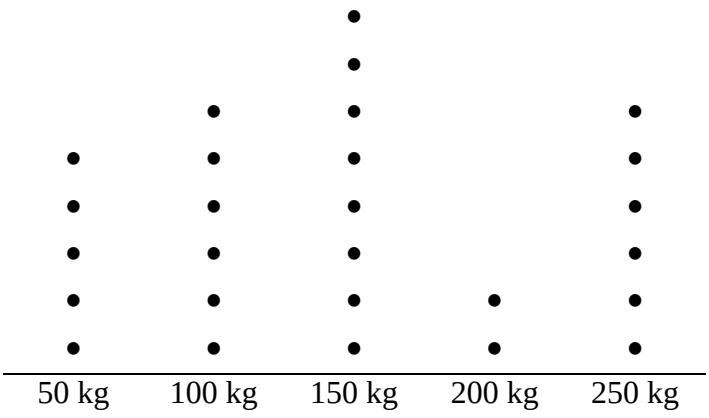


(A) 1584 litres
(B) 1848 litres
(C) 2112 litres
(D) 3696 litres

10 A share is valued at $23.40. Greg buys 4000 shares and at the end of the financial year Greg receives a dividend of $4212. The dividend yield on Greg's investment is:

(A) 0.55%
(B) 1.053%.
(C) 4.5%.
(D) 5.3%.

11 The dot plot below represents the number of drums on a large container ship.



Which of the following statements is *incorrect*?

(A) The range in weight of the drums is 200 kg.
(B) There are 27 drums on the ship.
(C) The median and the mode weights are represented by the 150 kg drums.
(D) The mean weight of the drums is approximately 145 kg.

12 At Westvale High School, there are 126 senior students and 574 junior students.

The student council wants to survey 100 students about the school's environmental program.

How many senior students should be selected for a stratified sample?

(A) 82

(B) 18

(C) 22

(D) 78

13 The sum of numbers $a, b, c \text{ and } d$ is 42.

If the mean of $a, b \text{ and } d$ is 12, what is the value of c?

(A) 6

(B) 10

(C) 14

(D) 18

14 Hamish measures the length of a piece of wood as 200 mm, correct to the nearest mm.

What is the percentage error in his measurement?

(A) $\pm 0.001\%$

(B) $\pm 0.0025\%$

(C) $\pm 0.1\%$

(D) $\pm 0.25\%$

15 The greatest return on a compound interest investment will be made if interest is compounded:

(A) monthly

(B) quarterly

(C) six-monthly

(D) annually

16 What is the point of intersection of $y = 2$ and $y = x + 4$?

(A) $(-2, -2)$

(B) $(-2, 2)$

(C) $(2, -2)$

(D) $(2, 2)$

17 A real estate agent sells a house for $950 000. From the selling price she earns $17 000 for her services. Which term is used to describe the money she earns?

(A) Commission

(B) Income tax

(C) Royalty

(D) Superannuation

18 Simplify $(4a)^2 + 3a^2$.

(A) $7a^2$

(B) $11a^2$

(C) $19a^2$

(D) $19a^4$

19 Chase was required to solve the equation $2(3-4x) = -(2x+3)$ for an assignment. This was his solution.

$$\begin{aligned} 6-8x &= -2x+3 && \text{Line 1} \\ -8x+2x &= 3-6 && \text{Line 2} \\ -6x &= -3 && \text{Line 3} \\ x &= 2 && \text{Line 4} \end{aligned}$$

Where is the error in Chase's working?

(A) Line 1 and line 3

(B) Line 1 and line 2

(C) Line 1 and line 4

(D) Line 1, line 2 and line 4

20 A luxury car was purchased new for $120 000.

By applying the declining balance method of depreciation, the salvage value, S, of the car at the end of n years of use is given by the equation:

$$S = 120\ 000(0.825)^n$$

What was the loss in the value of the car in the third year of its use correct to the nearest dollar?

(A) $3675

(B) $14293

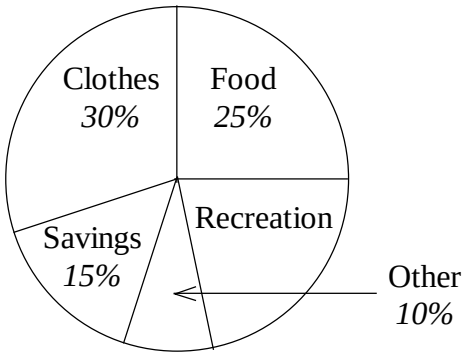
(C) $52618

(D) $38325

21 The speed of sound, called Mach 1 is 1224 km/hr.
Which of the following is this speed in m/s?

(A) 34
(B) 44
(C) 340
(D) 441

22 The sector graph below shows how Meenu spent her earnings from a part-time job.



If Meenu earned *$90*, how much did she spend on recreation?

(A) $6
(B) $9
(C) $20
(D) $18

End Of Section I

Section II

60 marks
Attempt Questions 23 – 27

Answer each question in the space provided.

Your responses should include relevant mathematical reasoning and/or calculations.

Question 23 (12 marks) **Marks**

(a) Garry is a travelling salesperson and drives 775 km per week.

(i) How many kilometres will Garry drive in one year? **1**

(ii) Garry's car is serviced every 10 000 km, costing approximately $380 each time. What is annual cost to service the car? **1**

(iii) Garry's car uses 7 L per 100 km and the cost of petrol is $1.20 per litre. How much does Garry pay for petrol in one year? **1**

(iv) In addition to servicing the car and petrol, Garry is required to pay registration for $390, compulsory third party insurance for $560 and comprehensive car insurance for $720. Calculate the total running costs for one year. **1**

(b) (i) Billie is a 65 kg female who went to a party and drank 12 standard drinks between 10.30 pm and 4.30 am. Estimate Billie's blood alcohol content. Answer correct to three decimal places. **2**

(ii) How long does Billie need to wait before she can drive back home if she possesses a provisional licence. **1**

The time need for BAC to reach zero after stopping drinking can be calculated using

$$\text{Number of hours for BAC to reach zero} = \frac{\text{BAC}}{0.015}$$

(c) The reaction distance and the braking distance are calculated using the formula:

$d1(\text{Reaction distance}) = \dfrac{5Vt}{18}$

$d2(\text{Braking distance}) = \dfrac{V^2}{180}$, where $d1$ and $d2$ are the distances in metres, V is the velocity in km/hr and t is the reaction time in seconds.

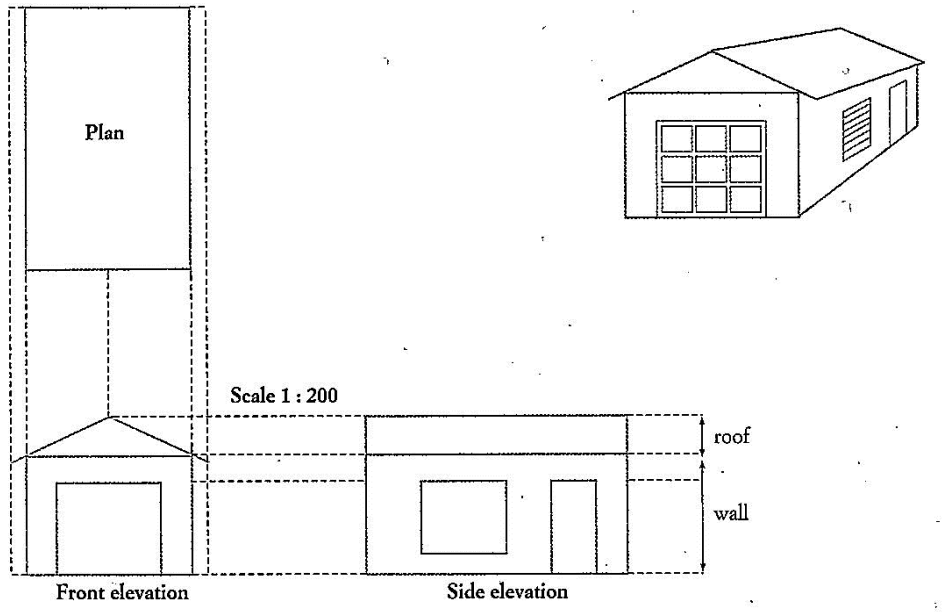
(i) Oliver uses the freeway to travel to work. His reaction time is 0.60 seconds. Calculate Oliver's stopping distance if he drives at the speed limit of 110 km/hr. Give your answer correct to 1 decimal place. **2**

(ii) Determine a safe distance correct to the nearest metre between cars on the freeway that are travelling at 110 km/hr. Give a reason for your answer. **1**

(iii) 'If you double your speed you need to double your braking distance.' Do you agree with the statement? Justify your answer with mathematical calculations. **2**

Question 24 (12 marks) **Marks**

(a) Below is a drawing of a garage, showing its plan, front and side elevations



(i) What is the floor area of the garage in square metres? **2**

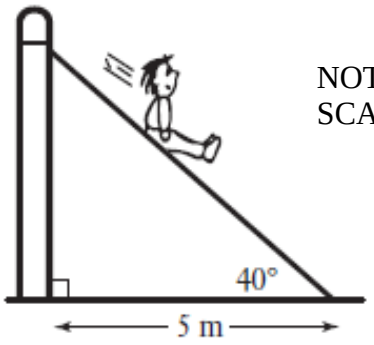
(ii) The floor of the garage needs to be painted. How many whole litres of paint would you need to buy to put two coats of paint on the floors if 1L covers $10m^2$? **2**

(b) A plane is flying 900 m above sea level. It is also 1200 m in a straight line to a ship. The angle of depression from the plane to the ship is θ.

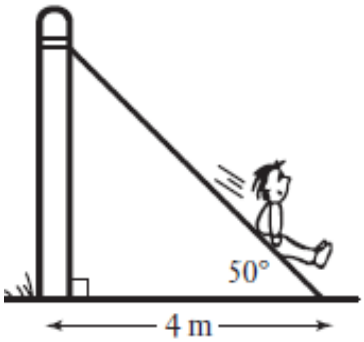
(i) Draw and label the above information on a diagram. **1**

(ii) Find the angle of depression correct to the nearest degree. **2**

(c) Macarthur Park has a slippery slide inclined at an angle of 40°, and the bottom of the slide is 5 m from the base of the ladder.
Strawberry Field has a slide inclined at 50°, and the bottom is 4 m from the base of the ladder.



NOT TO SCALE

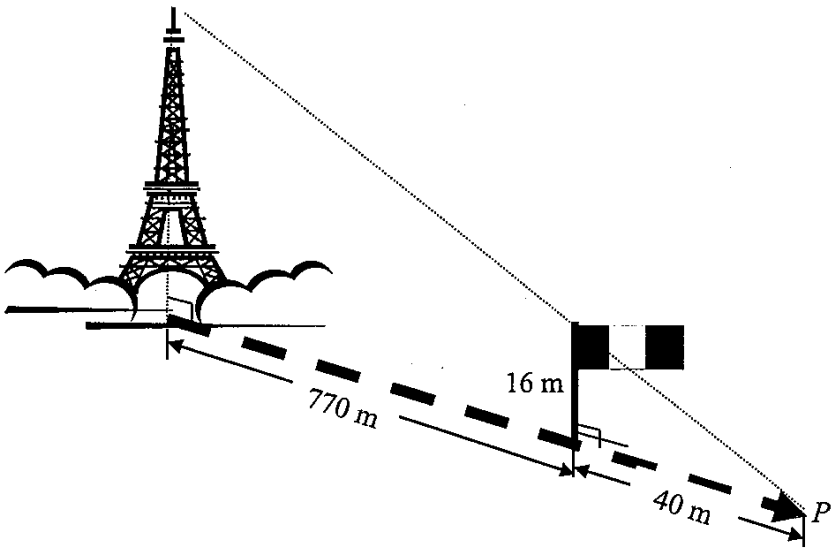


Macarthur Park Slide

Strawberry Field Slide

Which park has the longer slide? Justify your answer with appropriate calculations. **3**

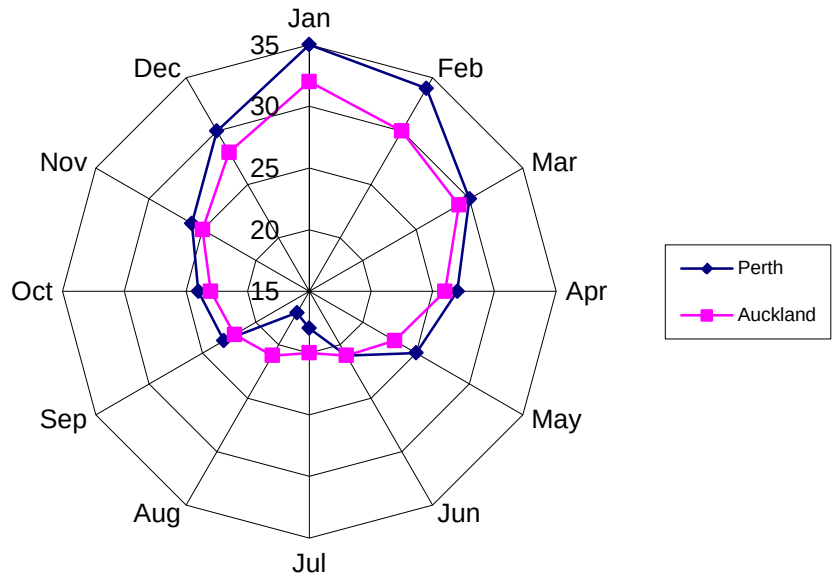
(d) The French flag is on a 16 m pole perpendicular to the ground at a position 770m from the foot of the Eiffel Tower in Paris. The ground is level. **2**



At night, a light beam shines from the top of the tower and reaches a point ***P***, along the ground, 40m from the flag pole. Show that the height of the tower is 324 m.

Question 25 (12 marks) **Marks**

(a) The radar chart compares the average temperature in degrees Celsius of two cities.



Note: The lowest temperature on the scale is 15°.

(i) What is the average temperature for Perth in January? **1**

_____

(ii) Which month has the lowest average temperature for Auckland? **1**

_____

_____

(iii) Which months is the temperature for Auckland greater than Perth? **1**

_____

_____

(iv) Calculate the range of average temperatures for Perth? **1**

_____

_____

_____

(b) A paint company says that 1 litre of paint can paint an area of 4 m^2. To test this, every 100^{th} can is tested to see that it will cover at least 4 m^2.

(i) What type of sample has been used? **1**

(ii) The paint is mixed in one of five machines. Every can tested therefore comes from the same machine. A quality control officer then says that the data are biased. **1**
Explain what could be done to prevent the data from being biased.

(c) The exam results for Year 11 students are given below in a frequency distribution table.

(i) Complete the cumulative frequency column in the table. **1**

Exam Marks	Frequency	Cumulative Frequency
1-20	33	
21-40	36	
41-60	37	
61-80	37	
81-100	24	

(ii) What percentage of students obtained more than 80 marks in the exam? Give your answer correct to 1 decimal place. **1**

(d) John draws up the questionnaire below to collect data for fitness of members of Poweractive Fitness Club.

Survey For Fitness.

1. Gender: (circle) Male / Female
2. Height _____ cm
3. Weight_____kg.
4. Number of people in your family who are members of the club (excluding yourself) _____
5. Your estimate of your fitness: (circle one)

Very Fit	Fairly Fit	Passably Fit	Fairly Unfit	Very Unfit

(i) Which question in the survey collects ***categorical, ordinal data?*** **1**

_____

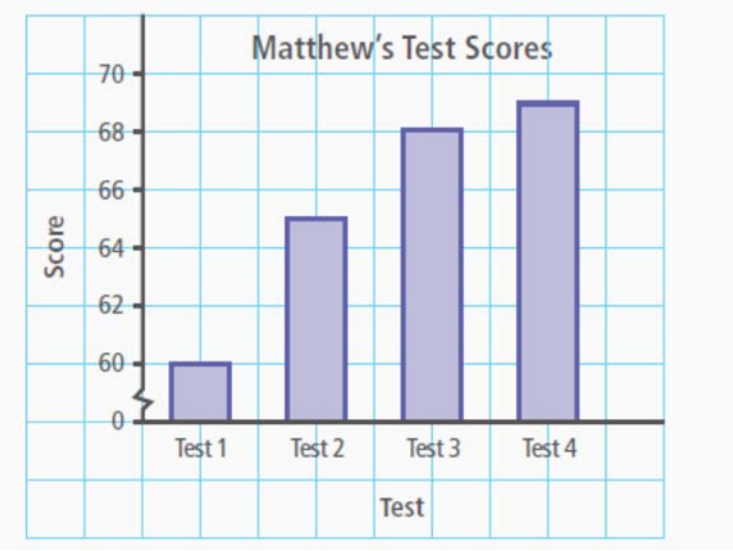
_____

(i) Which question in the survey collects ***discrete quantitative data?*** **1**

_____

_____

(e) Matthew's Math test scores are displayed on the column graph.



(i) The graph suggests that Matthew's test scores have improved significantly over the four tests. What part of the graph has been distorted to create this impression? **1**

_____

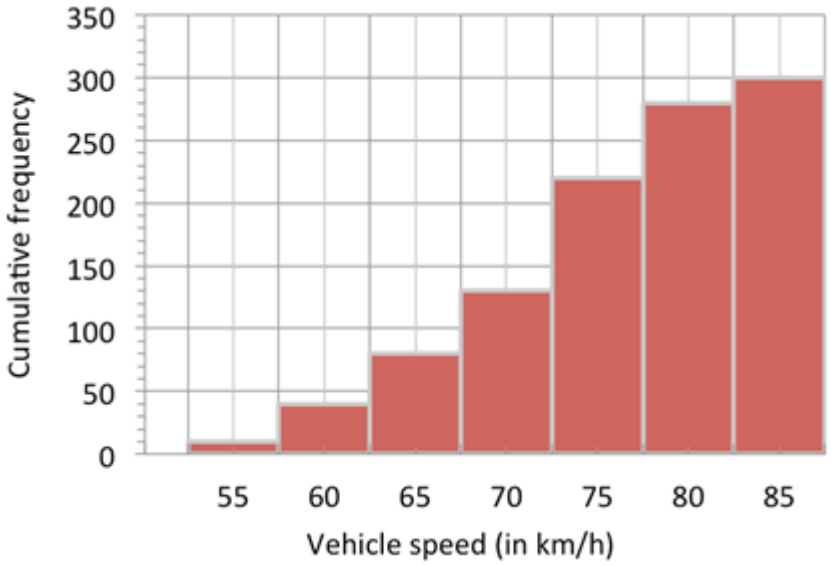
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(ii) Explain briefly how should the graph be drawn to represent Matthew's progress more accurately? **1**

Question 26 (12 marks) **Marks**

(a)

The speeds of a vehicle are shown in the cumulative frequency histogram.



(i) What is the frequency of 75 km/h? **1**

(ii) Construct a cumulative frequency polygon on the **above graph**. **1**

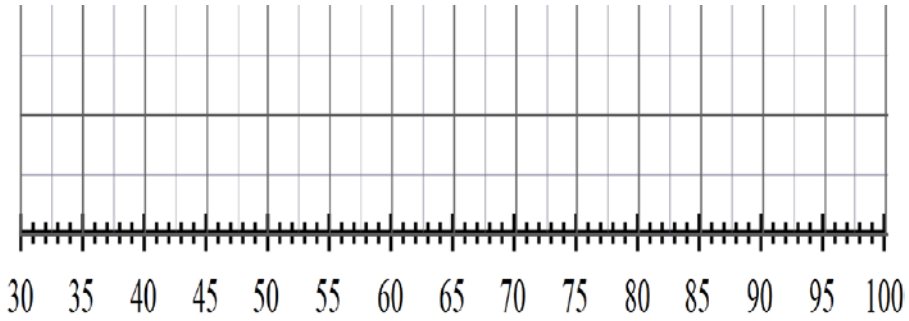
(iii) Use the cumulative frequency polygon to determine the median. **1**

(b) The scores by 30 players on a quiz are shown in the stem and leaf plot below.

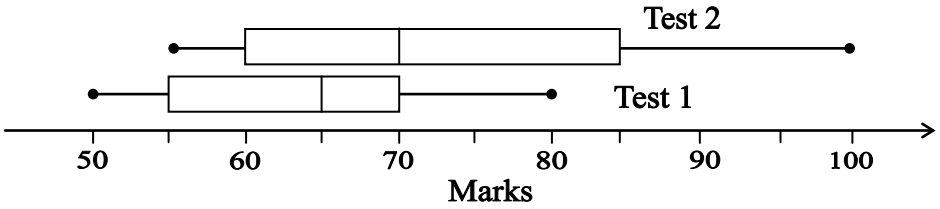
Stem	Leaf
3	3 6
4	2 5 6 7
5	5 5 7
6	0 3 5 5 8 8
7	4 4 7 7 7 9
8	0 5 5 8 8
9	1 5 5 9

(i) Write a five number summary for the scores. **1**

(ii) Using the scale below, draw a box and whisker plot for the scores. **1**



(c) The box and whisker plots below show the distribution of the marks of all students in a class for two tests.



In Test 1, the number of students who received marks of 70 or less is 18.

(i) Calculate the total number of students in the class. **1**

(ii) What percentage of students received marks of 70 or less in Test2? **1**

(d) Helen records her training time for ten 100m sprints below (in seconds).

12.5	13.0	11.5	13.0	13.5	11.5	12.0	13.5	11.5	13.0

(i) Calculate the mean of Helen's times. **1**

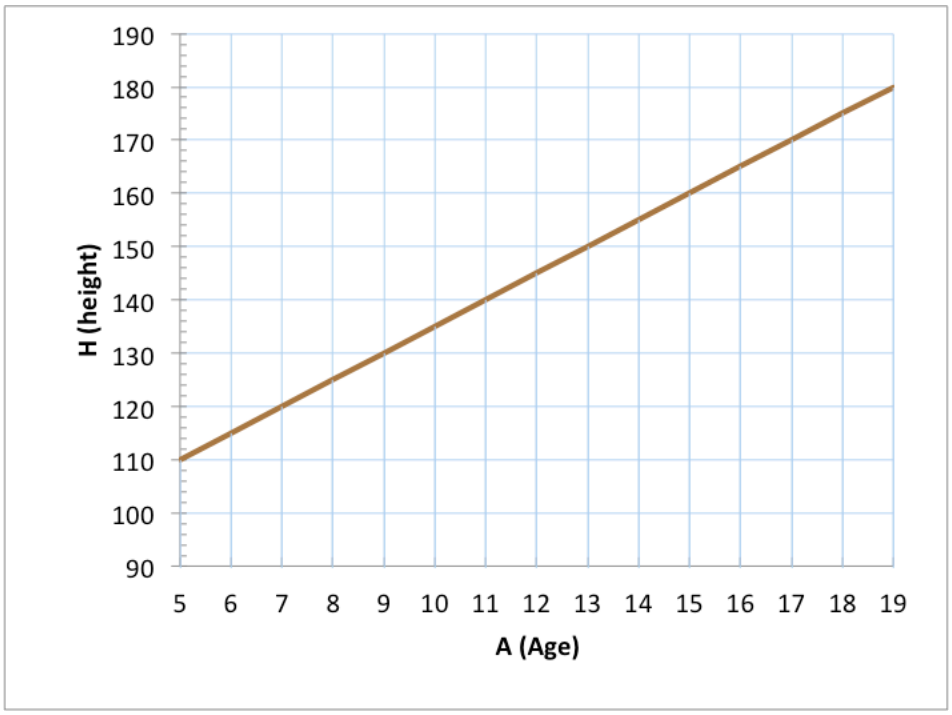
(ii) Calculate the standard deviation of Helen's times. Give your answer correct to 2 decimal places. **1**

(iii) The time for her 11^{th} sprint which is 14.5 seconds has been added to the Helen's training time. What will be the effect of this 11^{th} sprint on her mean and standard deviation? **2**

Question 27 (12 marks) **Marks**

(a) Expand and simplify $2p(p-q)+3p^2-6pq$ **1**

(b) The graph below compares a student's height (cm) to their age.



(ii) Determine the gradient of the straight-line graph. **1**

(iii) Write an equation that relates the height (H) to the age (A). **1**

(c) The Body Mass Index (B) is a measure used to evaluate healthy body mass.
The formula for B is

$$B = \frac{M}{h^2}$$ Where M = mass in kilograms and h = height in metres.

(i) Find the Body Mass Index for Robert whose height is 1.88 m and mass is 108 kg. Give your answer correct to 1 decimal place. **1**

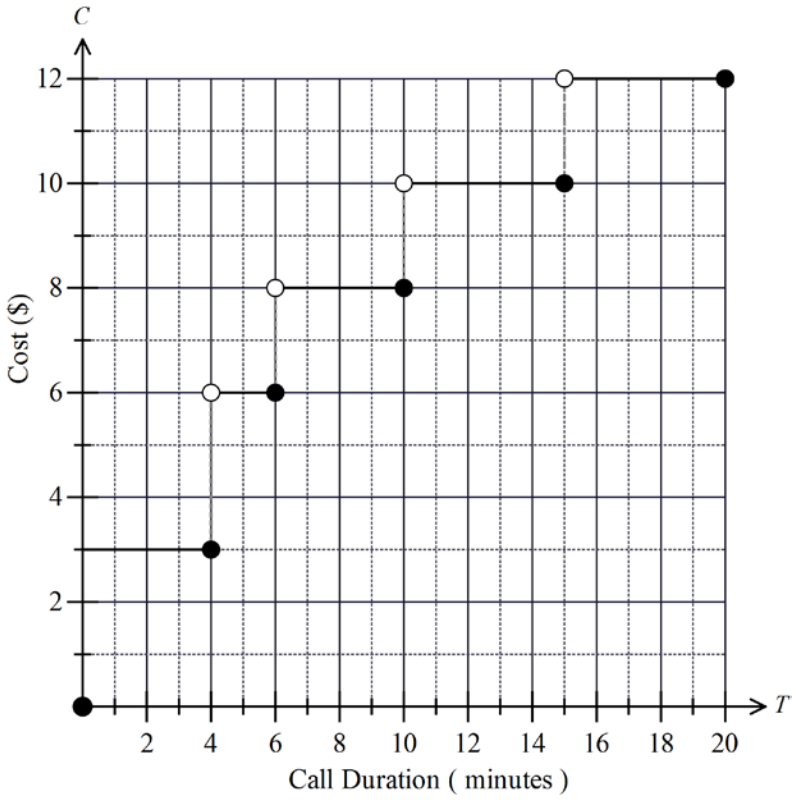
(ii) Erica has a Body Mass Index of 27.0 and is 1.54 m in height. **1**
What is Erica's mass? Give your answer correct to 1 decimal place.

(d) Michael receives a gross wage of $115 440 per annum.

(i) Calculate his gross weekly wage. **1**

(ii) Michael takes 4 weeks annual leave and is paid 17.5% holiday loading. What is Michael's total gross wages for his holidays? **2**

(e) The cost of calls on Candice's mobile phone plan can be represented by the graph below.



(i) Candice makes a call which lasts 10 minutes. How much does it cost her? **1**

(ii) After making the call in (i), Candice only has $6 of credit left. If Candice decides to make one phone call with her remaining credit. What would be her maximum call time? **1**

(f) The table below shows the compounded value when $1 is invested at the given interest rate for the given number of periods. The interest is compounded per period.

Period	**1.0%**	**1.5%**	**2.0%**	**2.5%**	**3.0%**	**3.5%**	**4.0%**
1	1.010	1.015	1.020	1.025	1.030	1.035	1.040
2	1.020	1.030	1.040	1.051	1.061	1.071	1.082
3	1.030	1.046	1.061	1.077	1.093	1.109	1.125
4	1.041	1.061	1.082	1.104	1.126	1.148	1.170
5	1.051	1.077	1.104	1.131	1.159	1.188	1.217
6	1.062	1.093	1.126	1.160	1.194	1.229	1.265

(i) What is the value of an investment of $8 500 invested at 4% p.a. compounded yearly after 3 years? **1**

(ii) Find the amount of money that needs to be invested at 3.5% p.a. compounded annually for 4 years, to grow to $55 678. **1**

End of paper

FORMULAE AND DATA SHEET

Financial Mathematics

Simple interest

$$I = Prn$$

- P is initial amount
- r is interest rate per period, expressed as a decimal
- n is number of periods

Compound interest

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

- A is final amount
- P is initial amount
- r is interest rate per period, expressed as a decimal
- n is number of compounding periods

Present value and future value

$$PV = \frac{FV}{(1+r)^n}, \quad FV = PV(1+r)^n$$

- r is interest rate per period, as expressed as a decimal
- n is number of compounding periods

Straight-line method of depreciation

$$S = V_0 - Dn$$

- S is salvage value of asset after n periods
- V_0 is initial value of asset
- D is amount of depreciation per period
- n is number of periods

Declining-balance method of depreciation

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

- S is salvage value of asset after n periods
- V_0 is initial value of asset
- r is depreciation rate per period, expressed as a decimal
- n is number of periods

Data Analysis

Mean of a sample

$$\bar{x} = \frac{\text{sum of scores}}{\text{number of scores}}$$

***z*-score**

For any score x,

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

- x is mean
- s is standard deviation

Outlier(s)

score(s) less than $Q_L - 1.5 \times IQR$ or

score(s) more than $Q_U + 1.5 \times IQR$

- Q_L is lower quartile
- Q_U is upper quartile
- IQR is interquartile range

Least-squares line of best fit

$$y = \text{gradient} \times x + y\text{-intercept}$$

$$\text{gradient} = r \times \frac{\text{standard deviation of } y \text{ scores}}{\text{standard deviation of } x \text{ scores}}$$

$$y\text{-intercept} = \bar{y} - (\text{gradient} \times \bar{x})$$

- r is correlation coefficient
- $\bar{x}$ is mean of x score
- $\bar{y}$ is mean of y scores

Normal distribution

- approximately 68% of scores have z-scores between –1 and 1
- approximately 95% of scores have z-scores between –2 and 2
- approximately 99.7% of scores have z-scores between –3 and 3

Spherical Geometry

Circumference of a circle

$$C = 2\pi r \text{ or } C = \pi d$$

r is radius

d is diameter

Arc length of a circle

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

r is radius

θ is number of degrees in central angle

Radius of Earth

(taken as) 6400 km

Time differences

For calculation of time differences using longitude: 15° = 1 hour time difference

Area

Circle

$$A = \pi r^2$$

r is radius

Sector

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

r is radius

θ is number of degrees in central angle

Annulus

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

R is radius of outer circle

r is radius of inner circle

Trapezium

$$A = \frac{h}{2}(a + b)$$

h is perpendicular height

a and b are the lengths of the parallel sides

Area of land and catchment areas

unit conversion: $1 \text{ ha} = 10\,000 \text{ m}^2$

Surface Area

Sphere

$$A = 4\pi r^2$$

r is radius

Closed cylinder

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

r is radius

h is perpendicular height

Volume

Prism or cylinder

$$V = Ah$$

r is radius

h is perpendicular height

Pyramid or cone

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

A is area of the base

h is perpendicular height

Volume and capacity

unit conversion: $1 \text{ m}^3 = 1000 \text{ L}$

Approximation Using Simpson's Rule

Area

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

h distance between successive measurements

d_f is first measurement

d_m is middle measurement

d_l is last measurement

Volume

$$V \approx \frac{h}{3}(A_L + 4A_m + A_R)$$

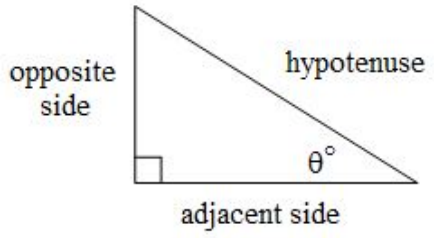
h distance between successive measurements

A_L is area of left end

A_M is area of middle

A_R is area of right end

Trigonometric Ratios



$$\sin\theta = \frac{\text{opposite side}}{\text{hypotenuse}}$$

$$\cos\theta = \frac{\text{adjacent side}}{\text{hypotenuse}}$$

$$\tan\theta = \frac{\text{opposite side}}{\text{adjacent side}}$$

Sine rule

In ΔABC

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

Cosine rule

In ΔABC

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

or

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

Units of Memory and File Size

1 byte = 8 bits

1 kilobyte = 2^{10} bytes = 1024 bytes

1 megabyte = 2^{20} bytes = 1024 kilobytes

1 gigabyte = 2^{30} bytes = 1024 megabytes

1 terabyte = 2^{40} bytes = 1024 gigabytes

Blood Alcohol Content Estimates

$$BAC_{Male} = \frac{(10N - 7.5H)}{6.8M} \text{ or}$$

$$BAC_{Female} = \frac{(10N - 7.5H)}{5.5M}$$

N is number of standard drinks consumed

H is number of hours of drinking

M is person's mass in kilograms

Distance, Speed and Time

$$D = ST,\ S = \frac{D}{T},\ T = \frac{D}{S}$$

$$\text{average speed} = \frac{\text{total distance travelled}}{\text{total time taken}}$$

$$\text{stopping distance} = \begin{Bmatrix}\text{reaction-time}\\ \text{distance}\end{Bmatrix} + \begin{Bmatrix}\text{braking}\\ \text{distance}\end{Bmatrix}$$

Probability of an Event

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

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

Straight Lines

Gradient

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

Gradient–intercept form

$$y = mx + b$$

m is gradient

b is y-intercept

SOLUTION

Multiple Choice Answer Sheet

Preliminary Mathematics General, AP2 2016

NAME.....

CLASS 11MTG.....

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

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

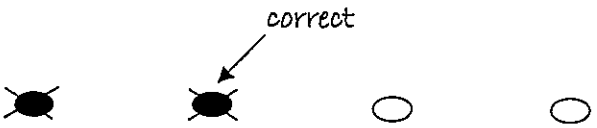
A ○ B ● C ○ D ○

20

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



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.



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

correct

correct

SOLUTIONS (MULTIPLE CHOICE)

1. $\frac{100x + 19y}{100}$

(C)

2. 4.56×10^{-5}

(B)

3. $\frac{1}{5} \times 9$

$1.8\ L$

(D)

4. $\frac{c}{a}$

(D)

5. 310

(A)

6. $x \times 36 + 4x \times x \times 1.5 = 1071$

$36x + 6x = 1071$

$42x = 1071$

$x = \frac{1071}{42}$

$= 25.50$

(B)

7. $\frac{1 + 6 + 18 + 8 + 5}{13}$

(A)

8. $2.5(1.02)^5$

$= \$2.76$

(D)

9. $V = A \times h$

$= \frac{0.6(1.2 + 1.6)}{2} 2.2$

$= 0.3(2.8)\,2.2$

$= 1.848\ m^3$

$= 1848\ L$

(B)

10. $\frac{4212}{23.4 \times 4000} \times 100$

$= 4.5\%$

(C)

11. (D)

12. $\frac{126}{700} \times 1000$

$= 18$

(B)

13. $\frac{a+b+c+d}{3} = 12$

$a+b+c+d = 42$

$a+b+d = 36$

$\therefore c = 6$

(A)

14. $\frac{\pm 0.5}{200} \times 100$

$= \pm 0.25\%$

(D)

15 A

16 $y = 2$ & $y = x + 4$

$y = x + 4$

$2 = x + 4$

$x = -2$

$(-2, 2)$

(B)

17 (A)

18 $(4a)^2 + 3a^2$

$16a^2 + 3a^2$

$19a^2$

(C)

19 Line 1 and Line 4

(C)

20. Salvage value after 3 years

$= 120\,000\,(0.825)^3$

$= \$67381.875$

Salvage value after 2 years $= 120\,000\,(0.825)^2$

$= 81675$

loss in value in the third year $= 67381.875 + 81675$

$= 14293.125$

(B)

21. $\frac{1224 \times 1000}{3600}$

$= 340$

(C)

22. $20\% \times 90$

$= \$18$

D

Section II

60 marks
Attempt Questions 23 – 27

Answer each question in the space provided.

Your responses should include relevant mathematical reasoning and/or calculations.

Question 23 (12 marks) **Marks**

(a) Garry is a travelling salesperson and drives 775 km per week.

(i) How many kilometres will Garry drive in one year? 1

$775 \times 52 = 40300$ km

(ii) Garry's car is serviced every 10 000 km, costing approximately \$380 each time. What is annual cost to service the car? 1

$\frac{40300}{10000} = 4.03 \simeq 4$ services

$\$380 \times 4 = \$1520$

(iii) Garry's car uses 7 L per 100 km and the cost of petrol is \$1.20 per litre. How much does Garry pay for petrol in one year? 1

$\frac{7}{100} \times 40300 \times 1.2$

$= \$3385.20$

(iv) In addition to servicing the car and petrol, Garry is required to pay registration for \$390, compulsory third party insurance for \$560 and comprehensive car insurance for \$720. Calculate the total running costs for one year. 1

Total Running Cost $= \$390 + \$560 + \$720 + \$1520 + 3385.20$

$= \$6575.20$

(b) (i) Billie is a 65 kg female who went to a party and drank 12 standard drinks between 10.30 pm and 4.30 am. Estimate Billie's blood alcohol content. Answer correct to three decimal places. **2**

$BAC_{female} = \frac{10N - 7.5H}{5.5M} = \frac{10 \times 12 - 7.5 \times 6}{5.5 \times 65}$ → 1 mark

$= 0.210$ 1 mark

(ii) How long does Billie need to wait before she can drive back home if she possesses a provisional licence. **1**

The time need for BAC to reach zero after stopping drinking can be calculated using

$$\text{Number of hours for BAC to reach zero} = \frac{\text{BAC}}{0.015}$$

$\frac{0.210}{0.015} = 14$ hours

(c) The reaction distance and the braking distance are calculated using the formula:

$d1$ (Reaction distance) $= \frac{5Vt}{18}$

$d2$ (Braking distance) $= \frac{V^2}{180}$, where $d1$ and $d2$ are the distances in metres, V is the velocity in km/hr and t is the reaction time in seconds.

(i) Oliver uses the freeway to travel to work. His reaction time is 0.60 seconds. Calculate Oliver's stopping distance if he drives at the speed limit of 110 km/hr. Give your answer correct to 1 decimal place. **2**

$d1 = \frac{5 \times 110 \times 0.6}{18} = 18.33$ m

$d2 = \frac{110^2}{180} = 67.22$ m } 1 mark

Stopping distance $= 18.33 + 67.22 = 85.6$ m

1 mark.

(ii) Determine a safe distance correct to the nearest metre between cars on the freeway that are travelling at 110 km/hr. Give a reason for your answer. **1**

Since the stopping distance is 85.6 m

∴ a minimum safe distance = 86 m.

(iii) 'If you double your speed you need to double your braking distance.' Do you agree with the statement? Justify your answer with mathematical calculations. **2**

$d_2 = \frac{V^2}{180}$

No, doubling the speed would quadruple the braking distance. (1 mark)

Consider d_2 when $V = 100$ km/hr

$d_2 = \frac{100^2}{180} = 55.55$

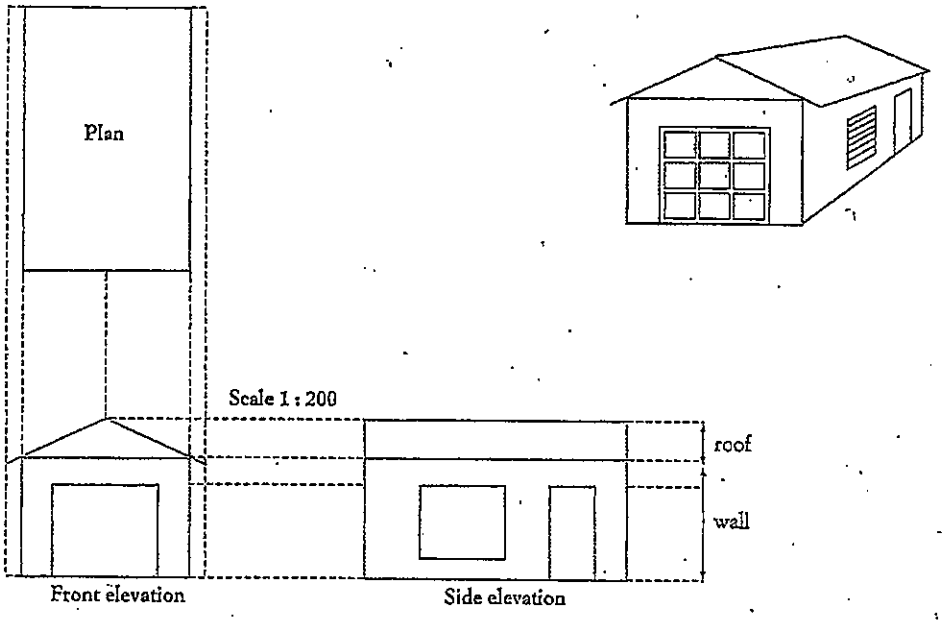
d_2 when $V = 200$ km/hr

$d_2 = \frac{200^2}{180} = 222.22$ ~~km/hr~~

(1 mark for justification)

Question 24 (12 marks) **Marks**

(a) Below is a drawing of a garage, showing its plan, front and side elevations



(i) What is the floor area of the garage in square metres? **2**

22mm by 34.5mm
Actual dimensions = 4.4m by 6.9m (1 mark)
Floor Area = 30.36 m^2 (1 mark)

(ii) The floor of the garage needs to be painted. How many whole litres of paint would you need to buy to put two coats of paint on the walls if 1L covers $10m^2$? **2**

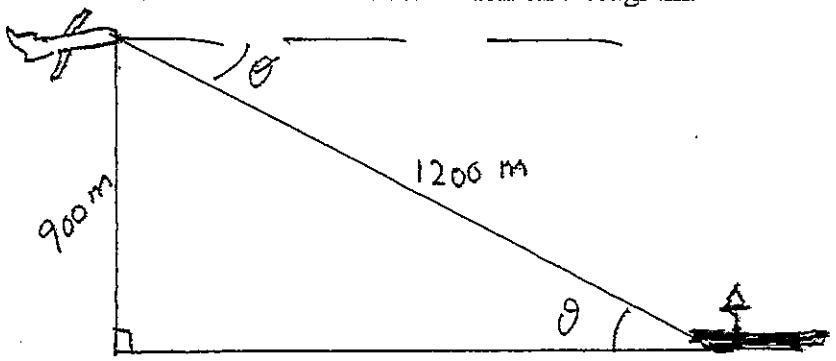
Litres of paint required to put one coat = $\frac{30.36}{10}$ = 3.036 L (1 mark)

for 2 coats = 6.072.

= 7 whole litres (1 mark)

(b) A plane is flying 900 m above sea level. It is also 1200 m in a straight line to a ship. The angle of depression from the plane to the ship is θ.

(i) Draw and label the above information on a diagram. **1**

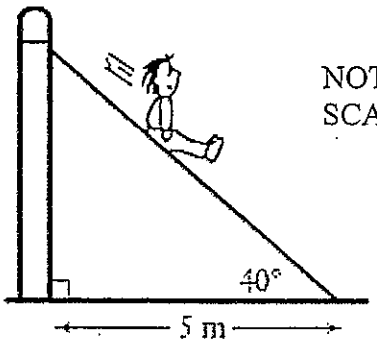


(ii) Find the angle of depression correct to the nearest degree. **2**

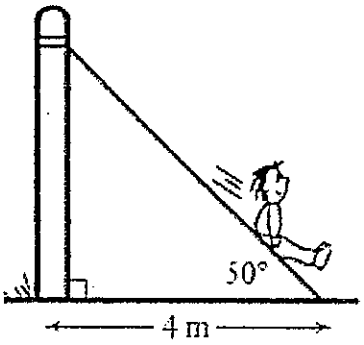
$\sin\theta = \frac{900}{1200}$ (1 mark)

$\theta = 49^\circ$ (1 mark)

(c) Macarthur Park has a slippery slide inclined at an angle of 40°, and the bottom of the slide is 5 m from the base of the ladder.
Strawberry Field has a slide inclined at 50°, and the bottom is 4 m from the base of the ladder.



NOT TO SCALE



Macarthur Park Slide

Strawberry Field Slide

Which park has the longer slide? Justify your answer with appropriate calculations. **3**

Macarthur Park

$\cos 40 = \frac{5}{x}$

$x = \frac{5}{\cos 40}$

$= 6.527$

Straw. Field

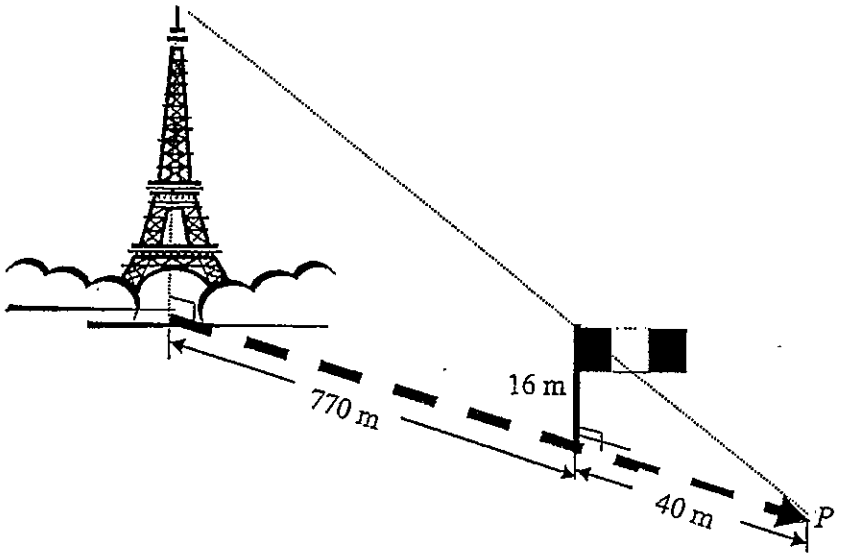
$\cos 50 = \frac{4}{x}$ 1 mark

$x = \frac{4}{\cos 50^\circ}$

$x = 6.2228$ 1 mark

∴ Macarthur Park has a longer Slide 1 mark

(d) The French flag is on a 16 m pole perpendicular to the ground at a position 770m from the foot of the Eiffel Tower in Paris. The ground is level. **2**



At night, a light beam shines from the top of the tower and reaches a point P, along the ground, 40m from the flag pole. Show that the height of the tower is 324 m.

h 810 m 16 40 m

$\frac{h}{16} = \frac{810}{40}$ (1 mark)

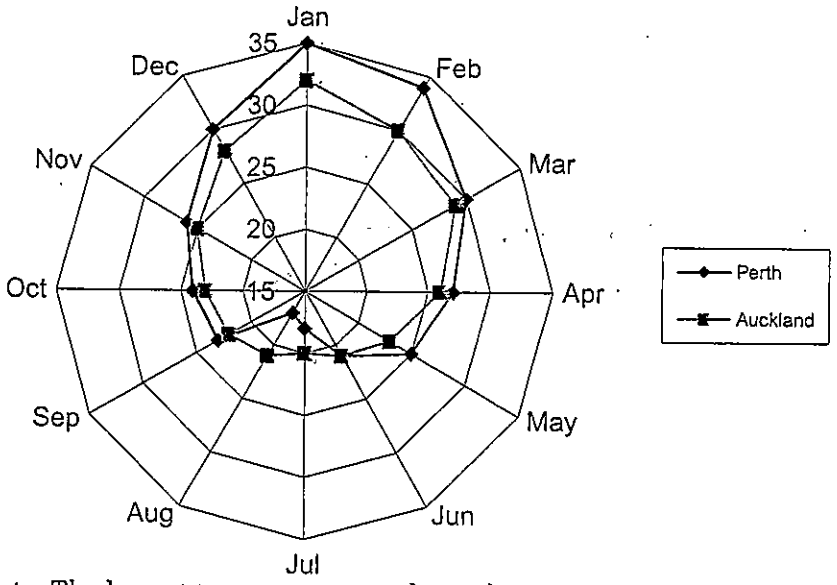
$h = \frac{810 \times 16}{40}$ 1 mark

$h = 324$ m (students have to show $h = 324$ m)

Question 25 (12 marks)

Marks

(a) The radar chart compares the average temperature in degrees Celsius of two cities.



Note: The lowest temperature on the scale is 15°.

(i) What is the average temperature for Perth in January? 1

35°C

(ii) Which month has the lowest average temperature for Auckland? 1

July

(iii) Which months is the temperature for Auckland greater than Perth? 1

July and August

only accepted June if they mentioned are the same

(iv) Calculate the range of average temperatures for Perth? 1

35 − 17

= 18°C ± 1°C.

accept 17°C − 19°C

* 35 − 5

X

(b) A paint company says that 1 litre of paint can paint an area of 4 m^2. To test this, every 100^{th} can is tested to see that it will cover at least 4 m^2.

(i) What type of sample has been used? **1**

systematic sampling

(ii) The paint is mixed in one of five machines. Every can tested therefore comes from the same machine. A quality control officer then says that the data are biased. **1**

Explain what could be done to prevent the data from being biased.

Change to random sampling

use cans from diff. machines

tested all five machines ✓

(c) The exam results for Year 11 students are given below in a frequency distribution table.

(i) Complete the cumulative frequency column in the table. **1**

Exam Marks	Frequency	Cumulative Frequency
1-20	33	33
21-40	36	69
41-60	37	106
61-80	37	143
81-100	24	167

✓

(ii) What percentage of students obtained more than 80 marks in the exam? Give your answer correct to 1 decimal place. **1**

$\frac{24}{167} \times 100 = 14.4\%$ ✓fm

accepted 14%.

(d) John draws up the questionnaire below to collect data for fitness of members of Poweractive Fitness Club.

Survey For Fitness.

1. Gender: (circle) Male / Female
2. Height _____ cm
3. Weight_____kg.
4. Number of people in your family who are members of the club (excluding yourself) _____
5. Your estimate of your fitness: (circle one)

Very Fit	Fairly Fit	Passably Fit	Fairly Unfit	Very Unfit

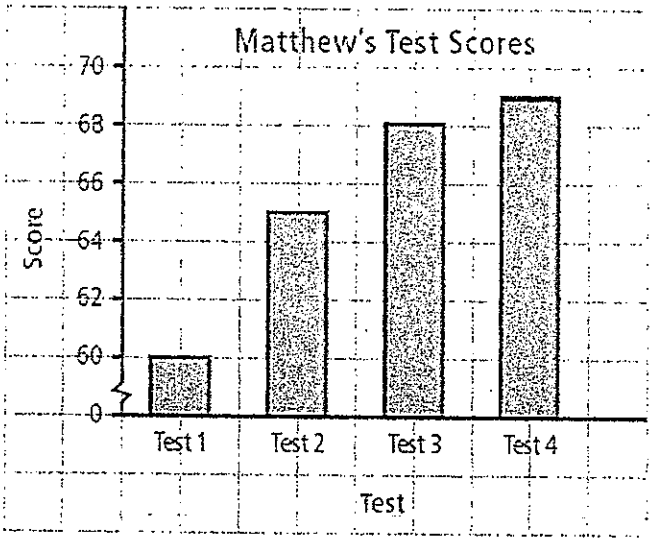
(i) Which question in the survey collects ***categorical, ordinal data?*** 1

Q5

(i) Which question in the survey collects ***discrete quantitative data?*** 1

Q4

(e) Matthew's Math test scores are displayed on the column graph.



(i) The graph suggests that Matthew's test scores have improved significantly over the four tests. What part of the graph has been distorted to create this impression? 1

the y-axis scale.

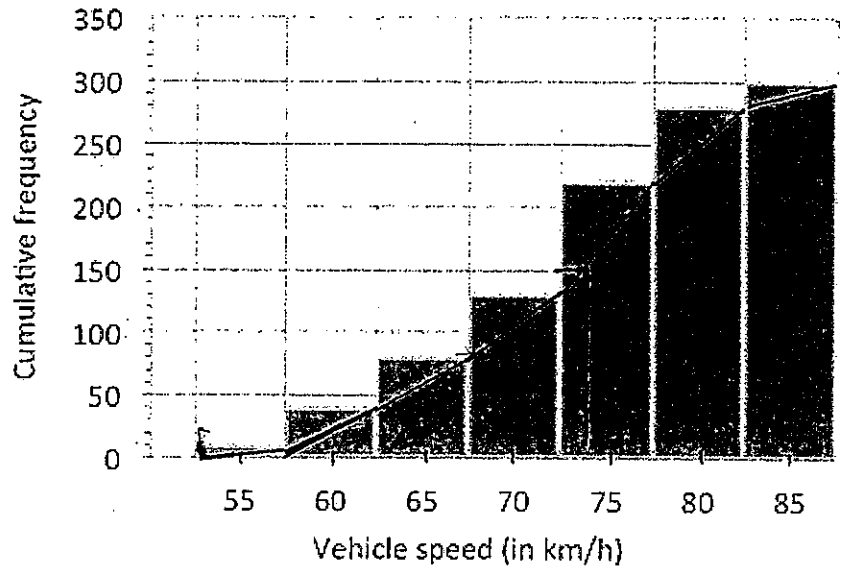
(ii) Explain briefly how should the graph be drawn to represent Matthew's progress more accurately? **1**

change the scale on the y-axis.

Question 26 (12 marks) **Marks**

(a)

The speeds of a vehicle are shown in the cumulative frequency histogram.



(i) What is the frequency of 75 km/h? **1**

220 - 130

90

(ii) Construct a cumulative frequency polygon on the above graph. **1**

(iii) Use the cumulative frequency polygon to determine the median. **1**

73 Km/hr

72 to 74 accepted

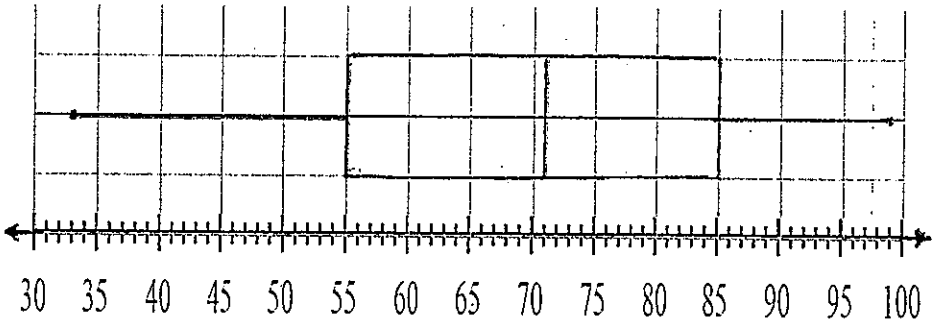
(b) The scores by 30 players on a quiz are shown in the stem and leaf plot below.

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

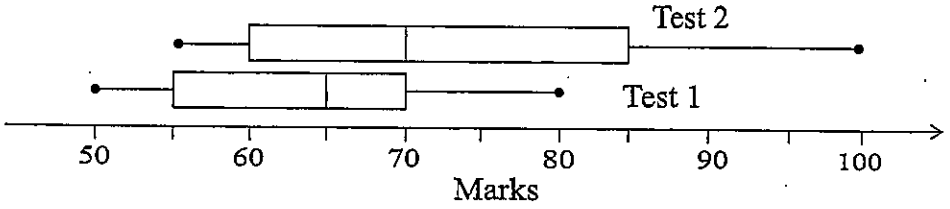
(i) Write a five number summary for the scores. 1

33, 55, 71, 85, 99

(ii) Using the scale below, draw a box and whisker plot for the scores. 1



(c) The box and whisker plots below show the distribution of the marks of all students in a class for two tests.



In Test 1, the number of students who received marks of 70 or less is 18.

(i) Calculate the total number of students in the class. 1

24

(ii) What percentage of students received marks of 70 or less in Test2? 1

50%

(d) Helen records her training time for ten 100m sprints below (in seconds).

12.5	13.0	11.5	13.0	13.5	11.5	12.0	13.5	11.5	13.0

(i) Calculate the mean of Helen's times. **1**

12.5

(ii) Calculate the standard deviation of Helen's times. Give your answer correct to 2 decimal places. **1**

0.77

(iii) The time for her 11th sprint which is 14.5 seconds has been added to the Helen's training time. What will be the effect of this 11th sprint on her mean and standard deviation? **2**

$\bar{x} = 12.68$

Mean is increased slightly and so is the standard deviation (1 mark)

0.94

(1 mark for justification using mathematical calculations)

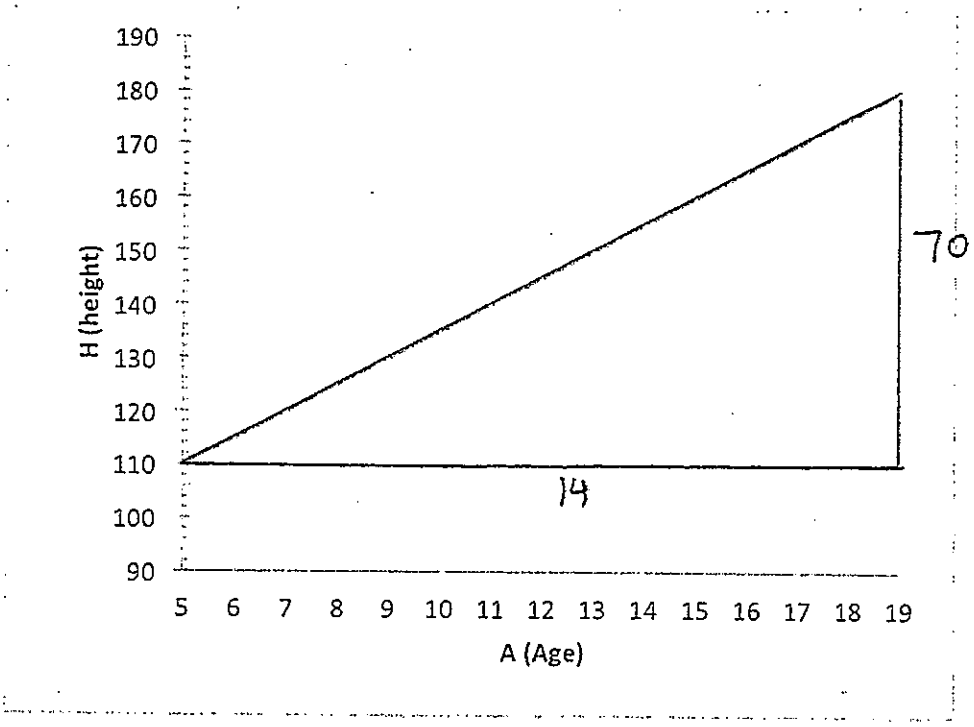
Question 27 (12 marks) **Marks**

(a) Expand and simplify $2p(p-q)+3p^2-6pq$ **1**

$2p^2-2pq+3p^2-6pq$

$5p^2-8pq$

(b) The graph below compares a student's height (cm) to their age.



(ii) Determine the gradient of the straight-line graph. **1**

$\frac{70}{14} = 5$

(iii) Write an equation that relates the height (H) to the age (A). **1**

$H = 5 \times A + 110$

(c) The Body Mass Index (B) is a measure used to evaluate healthy body mass. The formula for B is

$$B = \frac{M}{h^2}$$ Where M = mass in kilograms and h = height in metres.

(i) Find the Body Mass Index for Robert whose height is 1.88 m and mass is 108 kg. Give your answer correct to 1 decimal place. **1**

$B = \frac{108}{1.88^2}$

$= 30.6$

(ii) Erica has a Body Mass Index of 27.0 and is 1.54 m in height. **1**
What is Erica's mass? Give your answer correct to 1 decimal place.

$27 = \frac{M}{1.54^2}$

$M = 64.0$ kg

64.1 accepted only with working ✓

(d) Michael receives a gross wage of \$115 440 per annum.

(i) Calculate his gross weekly wage. **1**

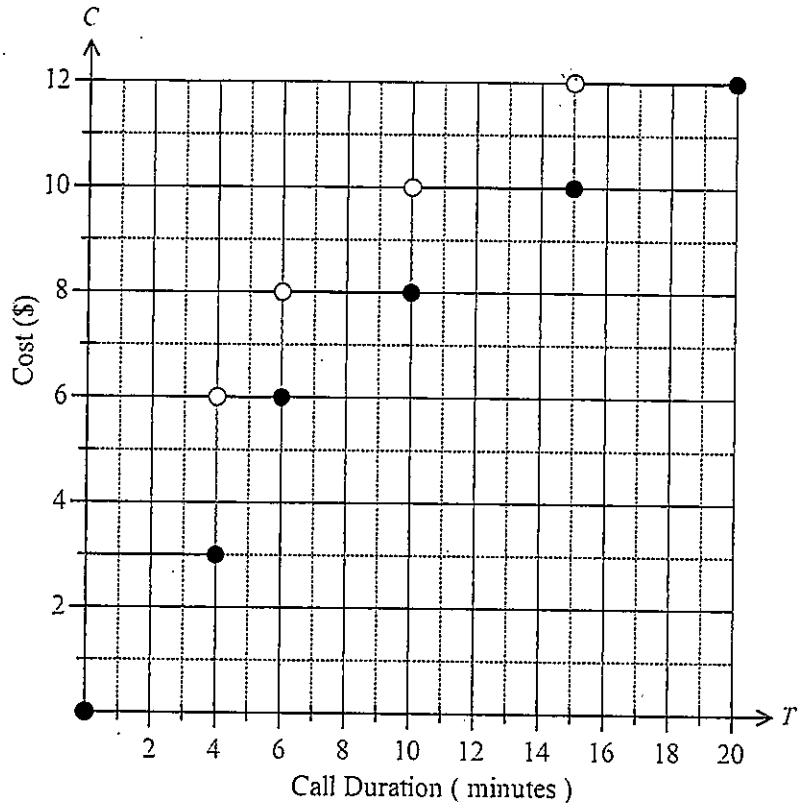
Weekly Wage $= 115440 \div 52$
$= \$2220$

(ii) Michael takes 4 weeks annual leave and is paid 17.5% holiday loading. What is Michael's total gross wages for his holidays? **2**

Holiday Loading $= 2220 \times 4 \times 17.5\%$
$= \$1554.$ → 1 mark

Total Holiday Pay $= 2220 \times 4 + 1554$
$= \$10434$ → 1 mark.

(e) The cost of calls on Candice's mobile phone plan can be represented by the graph below.



(i) Candice makes a call which lasts 10 minutes. How much does it cost her? **1**

$8

(ii) After making the call in (i), Candice only has $6 of credit left. If Candice decides to make one phone call with her remaining credit. What would be her maximum call time? **1**

6 mins

(f) The table below shows the compounded value when \$1 is invested at the given interest rate for the given number of periods. The interest is compounded per period.

Period	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%
1	1.010	1.015	1.020	1.025	1.030	1.035	1.040
2	1.020	1.030	1.040	1.051	1.061	1.071	1.082
3	1.030	1.046	1.061	1.077	1.093	1.109	1.125
4	1.041	1.061	1.082	1.104	1.126	1.148	1.170
5	1.051	1.077	1.104	1.131	1.159	1.188	1.217
6	1.062	1.093	1.126	1.160	1.194	1.229	1.265

(i) What is the value of an investment of \$8 500 invested at 4% p.a. compounded yearly after 3 years? 1

8500×1.125

$= \$9562.5$

$8500\left(\frac{1.04}{1.125}\right)^3$

$= 9561.34$

accepted values from the table as well as substitution in the formula.

(ii) Find the amount of money that needs to be invested at 3.5% p.a. compounded annually for 4 years, to grow to \$55 678. 1

$\frac{55\,678}{1.148} = \$48\,500$

End of paper

$\frac{55678}{(1.035)^4} = \$48520.16$

Mathematics KLA | **Exam Feedback from Markers**

Paper: **Y11 AP2 General** Question: **23** Marker: **Eddie**

Please write any feedback that you (as a marker) would like conveyed to all teachers regarding the section you marked of the paper. Suggestions for what you might write include:

- This question was very well / poorly done
- Most students took this path…
- The most common error was…
- I have awarded a mark for … but students should know they must take a different approach

Question part	Feedback
a)	For all parts of this question, no marks were awarded to students who made carry-forward errors if the working out was not shown.
a) ii)	Many students calculated the cost of 4.03 services rather than 4 services, but this was still accepted if working was shown.
a) iii) & iv)	Numerous students wrote \$3385.2 instead of \$3385.20 – this wasn't penalised but please emphasise the correct way to write currency.
b)	Substitution into the formula (not just quoting the formula) is required for the first mark. The most common error was for students to miscalculate the number of hours. An alarming number of students gave ridiculous answers (e.g. BAC greater than 1), which suggests they do not understand what BAC actually means.
c) i)	The most common error was for students to ignore reaction time and not calculate d1 at all.
c) ii)	Several students completely ignored the connection with the previous part of the question. A variety of nonsensical answers (e.g. 1m as a safe distance from the car in front) were offered.
c) iii)	To score full marks, students had to include calculations and use words to indicate the meaning or relevance of those calculations. Many students simply wrote down calculations but did not offer any explanation, so that did not "justify" their conclusion.

Mathematics KLA | **Exam Feedback from Markers**

Paper: 411 AP2 Gen Question: 24 Marker: Hamish

Please write any feedback that you (as a marker) would like conveyed to all teachers regarding the section you marked of the paper. Suggestions for what you might write include:

- This question was very well / poorly done
- Most students took this path…
- The most common error was…
- I have awarded a mark for … but students should know they must take a different approach

Too many non attempts

Question part	Feedback
a) (i)	need to mult by 200 twice & ÷ 10000 to change units- ## in cm^2
(ii)	1st mark resonable 2nd not very good.
b) (i) (ii)	Poor. Poor ~~use of~~ understanding of setting out of trig questions too many did no working at all.
c)	Poor working out. Very few showed the working that the marker would Poor understanding of trig notation. No marks for stating the larger with out any working.
d)	Poor It was allowed to slide if students rounded to early.

Please return this to Eddie once you are finished.

The = sign is poorly used by many students statements like $3 \times 4 = 12 \times 10$ $= 120$ are wrong

Mathematics KLA | **Exam Feedback from Markers**

Paper: Y11 AP2 Gen Question: 25 Marker: Jo

Please write any feedback that you (as a marker) would like conveyed to all teachers regarding the section you marked of the paper. Suggestions for what you might write include:

- This question was very well / poorly done
- Most students took this path…
- The most common error was…
- I have awarded a mark for … but students should know they must take a different approach

Question part	Feedback
(a)	(iii) Answer is July, August. If students added June this was not awarded. Only awarded mark if they stated in June that it was the same for Auckland + Perth
	(iv) Range not done well accepted 17 – 19°C only
(b)	Done poorly (i) Systematic sampling alot of terms used that did not make sense. ie.
	(ii) needed to test in all five - random sampling would have been the most obvious response
(c)	again poorly answered. (i) Alot of students said that the scale did not start at 0. It started at 60??
	(ii) only cfm if they said to start at 0 if they mentioned 'did not start at 0 in part (i)..?

Please return this to Eddie once you are finished.

Mathematics KLA | **Exam Feedback from Markers**

Paper: Y11 AP2 Gen Question: 26 Marker: Chris

Please write any feedback that you (as a marker) would like conveyed to all teachers regarding the section you marked of the paper. Suggestions for what you might write include:

- This question was very well / poorly done
- Most students took this path…
- The most common error was…
- I have awarded a mark for … but students should know they must take a different approach

Question part	Feedback
26 a) ii) →	Many joined to middle of column
i) →	220 was common error
b)	Didn't know what 5 number summary was, but could still do box and whisker
c) i) + ii)	Done poorly overall
d) iii)	Many didn't state the effect i.e. an increase.
	If calculated new mean + sd, but didn't mention increase → 1 mark
	If did calculate one + said increase → 1 mark

Please return this to Eddie once you are finished.

Mathematics KLA | **Exam Feedback from Markers**

Paper: 911 AP2 Gen Question: 27 Marker: Garry

Please write any feedback that you (as a marker) would like conveyed to all teachers regarding the section you marked of the paper. Suggestions for what you might write include:

- This question was very well / poorly done
- Most students took this path…
- The most common error was…
- I have awarded a mark for … but students should know they must take a different approach

Question part	Feedback
a).	Not many students could expand / and simplify.
b).	Very few students could find the gradient correctly. Those who could find gradient had trouble writing equation of a line in $y=mx+b$ form.
c) & d).	part (c) and (d) are attempted by most of the students correctly.
e).	Students should revise step graphs as not many got this question right.
f)	Students were able to find Amount using compound interest table. Some used the formula and were given full marks.

Please return this to Eddie once you are finished.