2010 HSC HALF YEARLY EXAMINATION

HSC General Mathematics

Teachers: **Mr T Flavell**
Mr S Fraser

Date: **Monday 29th March**
Time: **9.25 – 12.00**

General Instructions

- Reading time – 5 minutes
- Working time - 2½ hours
- Write using blue or black pen or lead pencil
- Calculators may be used
- A Formulae Sheet is provided

Section I Pages 2 - 8
Total marks (**22**)
- Attempt Questions 1 – 22
- Allow about 30 minutes for this section
- Use the multiple choice answer sheet for this section

Section II pages 9 – 14
Total marks (**78**)
- Attempt Questions 23 – 28
- Allow about 2 hours for this section
- Use writing paper provided for this section

Section I
Total marks (22)
Attempt Questions 1 – 22
Allow about 30 minutes for this section
Use the Multiple-Choice Answer sheet provided

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1 $2x(3x - 4y) =$

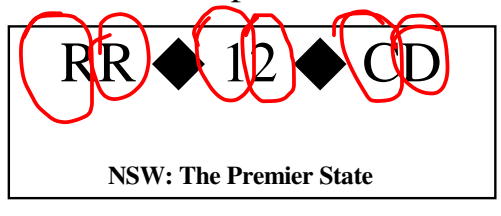
(A) $5x - 6xy$

(B) $5x^2 - 6xy$

(C) $6x - 8xy$

(D) $6x^2 - 8xy$

2 NSW recently introduced a new system for car number plates. The system uses two letters followed by two numbers followed by another two letters. James owns a Rolls Royce and wants the first two letters of the number plate to be RR.



$10 \times 10 \times 26 \times 26$

The number of possible plates that James could get is:

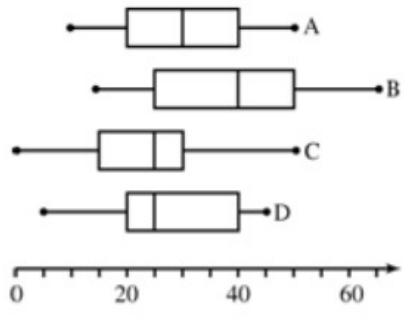
(A) 67 600

(B) 456 976

(C) 1 679 616

(D) 45 697 600

3 Examine the following diagram.

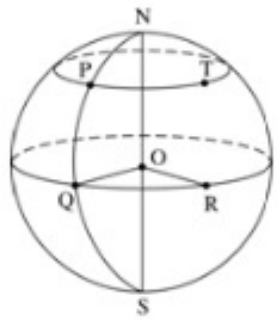


The company with the most symmetrically distributed data is:

A Company A
B Company B
C Company C
D Company D

4

The figure drawn below shows a sphere, centre O.



Which of the following pair of points DOES NOT lie on a great circle?

A N and S
B Q and R
C P and Q
D P and T

5 The expression $\dfrac{9m^3 \times 8m^4}{(4m^3)^2}$ is equal to:

A $\dfrac{9m}{2}$
B $\dfrac{9}{2m}$
C $\dfrac{9m^2}{2}$
D $\dfrac{9}{2m^2}$

$\dfrac{72m^7}{16m^6} = \dfrac{9m}{2}$

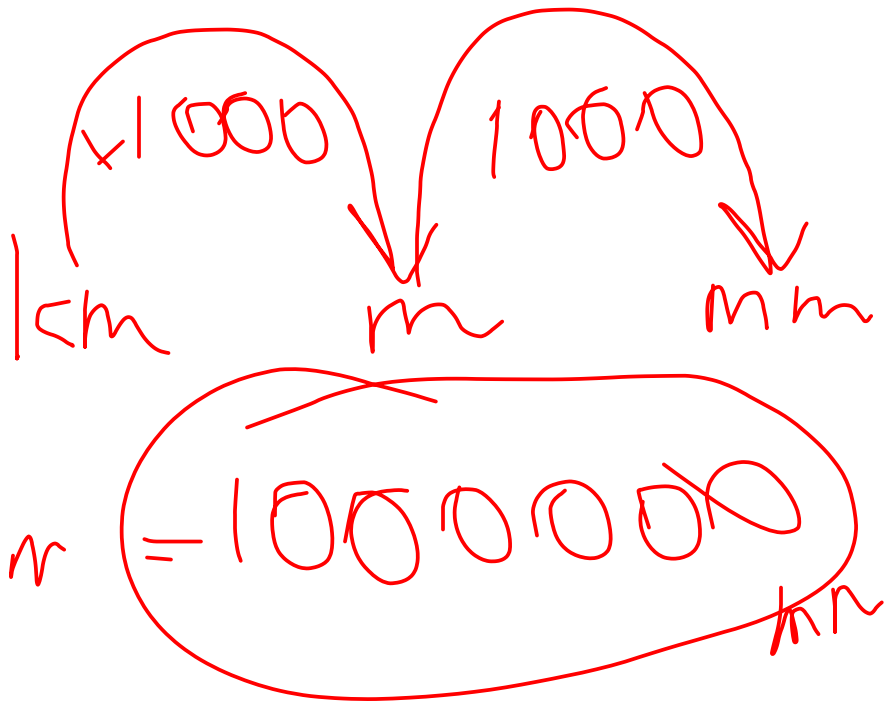
6 The expression 2.7×10^9 km is equal to:

(A) 2.7×10^{12} mm

(B) 2.7×10^{8} mm

(C) 2.7×10^{10} mm

(D) 2.7×10^{15} mm



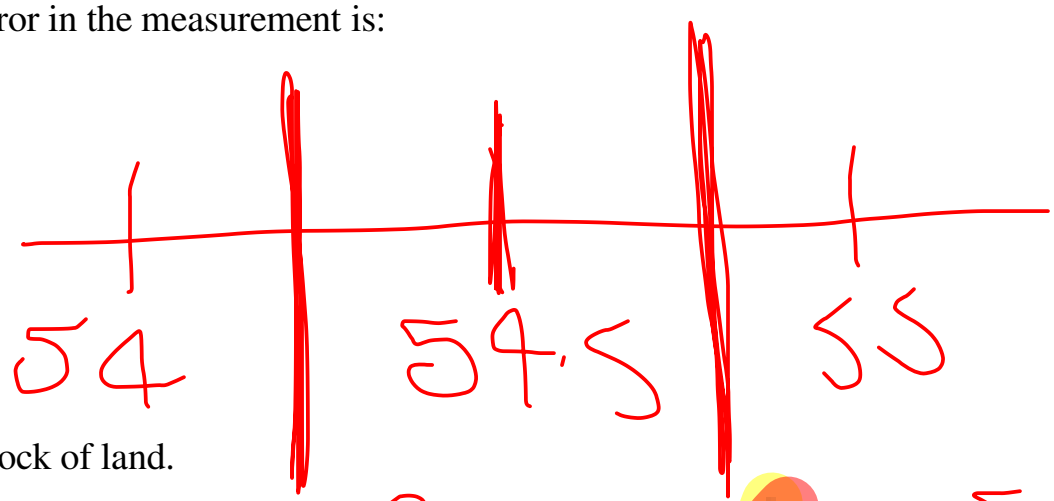
7 The weight of a jockey in a horse race is measured as 54.5 kg correct to the nearest half-kilogram. The maximum error in the measurement is:

(A) 0.1 kg

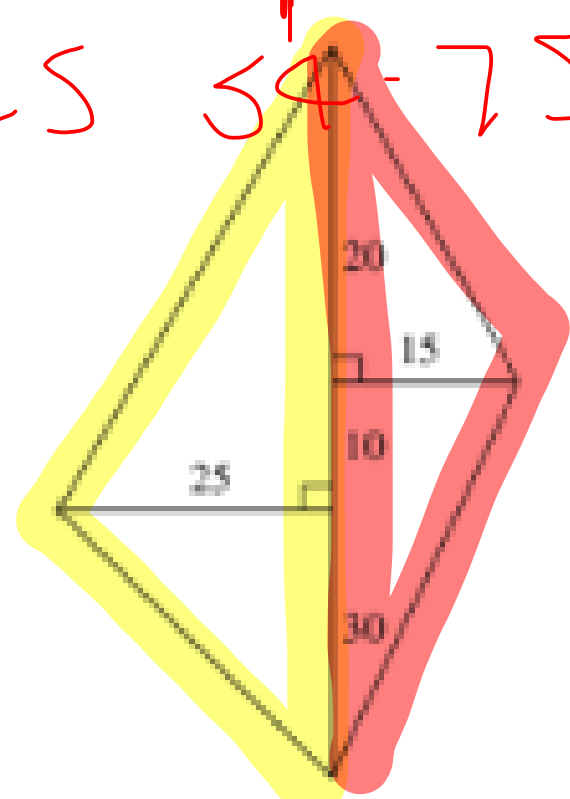
(B) 0.25 kg

(C) 0.5 kg

(D) 1 kg



8 The scale drawing is of a block of land.



The area of the block of land is:

(A) 475 m^2

(B) 525 m^2

(C) 725 m^2

(D) 1200 m^2

9 The future value of an annuity in which $5000 is invested at 6% p.a. for 10 years with interest compounded annually is:

(A) $3954.23

(B) $8954.23

(C) $60 903.97

(D) $65 903.97

10 Which of the following tables shows straight-line depreciation?

A

Age (years)	Value
New (0)	$6,000
1	$5,400
2	$4,860
3	$4,374
4	$3,937
5	$3,543

B

Age (years)	Value
New (0)	$6,000
1	$5,400
2	$4,900
3	$4,500
4	$4,200
5	$4,000

C

Age (years)	Value
New (0)	$6,000
1	$5,400
2	$4,700
3	$4,000
4	$3,200
5	$2,300

D

Age (years)	Value
New (0)	$6,000
1	$5,400
2	$4,800
3	$4,200
4	$3,600
5	$3,000

11 The minimum monthly repayment on a credit card is the greater of $10 or 5% of the outstanding balance. Nadia has a minimum monthly repayment of $10 on her credit card. The outstanding balance on Nadia's credit card could not be:

(A) $99.50

(B) $100.50

(C) $101.50

(D) $1001.50

$0.05x > 10$

$x > 200$

12 Kalgoorlie is at coordinates (30°S, 120°E). The local time in Kalgoorlie is:

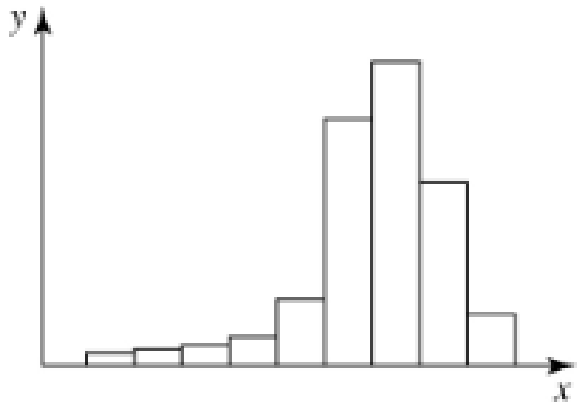
(A) GMT -8

(B) GMT -2

(C) GMT +2

(D) GMT +8

13 Examine this histogram.



The distribution of the data could be described as:

A negatively skewed
B positively skewed
C symmetric
D there is insufficient information on the graph to determine the skewness

14 A class of students had a mathematics exam and the results are such that the mean mark is 68 and the standard deviation is 9. Julie was sick on the day of the exam and did the exam later, obtaining a mark of 73.

Which of the following statements is correct?

(A) The mean will decrease and the standard deviation will decrease.

(B) The mean will decrease and the standard deviation will increase.

(C) The mean will increase and the standard deviation will increase.

(D) The mean will increase and the standard deviation will decrease.

15 Which of the following is the highest annual salary?

(A) $1113 per week

(B) $2220 per fortnight

(C) $4800 per month

(D) $57 800 per annum

16

A loan is to be taken out over a 5-year term at a flat interest rate of 8% p.a.

The formula $E = \dfrac{(1+r)^n - 1}{n}$ gives an effective interest rate of:

A 5.52%
B 5.53%
C 9.38%
D 9.39%

17 Which of the following pieces of data can be considered to be discrete data?

(A) The heights, in cm, of a group of Year 11 students

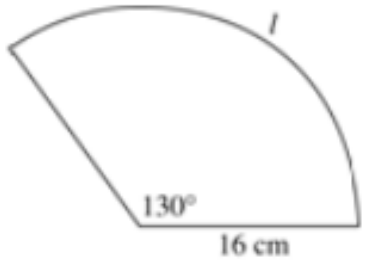
(B) Dress sizes in stock at a clothing store

(C) The daily maximum temperature

(D) The types of movies that people like to watch

18

Consider the figure drawn below.



The arc length l is closest to:

A 18 cm
B 36 cm
C 68 cm
D 73 cm

19 Given $v^2 = u^2 + 2as$, the value of s when $v = 15$, $u = 12$ and $a = 4.5$ is:

(A) 1

(B) 3

(C) 4.5

(D) 9

$15^2 = 12^2 + 2 \times 4.5 \times s$
$225 = 144 + 9s$
$81 = 9s$
$9 = s$

20 A home loan has an annual reducible interest rate of 7.2% p.a. The monthly interest rate expressed as a decimal is:

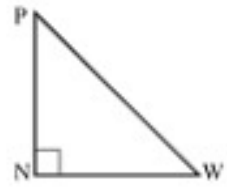
(A) 0.0006

(B) 0.006

(C) 0.06

(D) 0.6

21 For the diagram below, which of the following statements is correct?



A $\tan N = \frac{NW}{PN}$

B $\cos P = \frac{NW}{PW}$

C $\sin W = \frac{PN}{PW}$

D $\tan P = \frac{PN}{NW}$

22 In the formula $T = ar^{n-1}$ the value of T when $a = 2$, $r = 3$ and $n = 4$ is:

(A) 54

(B) 161

(C) 216

(D) 1295

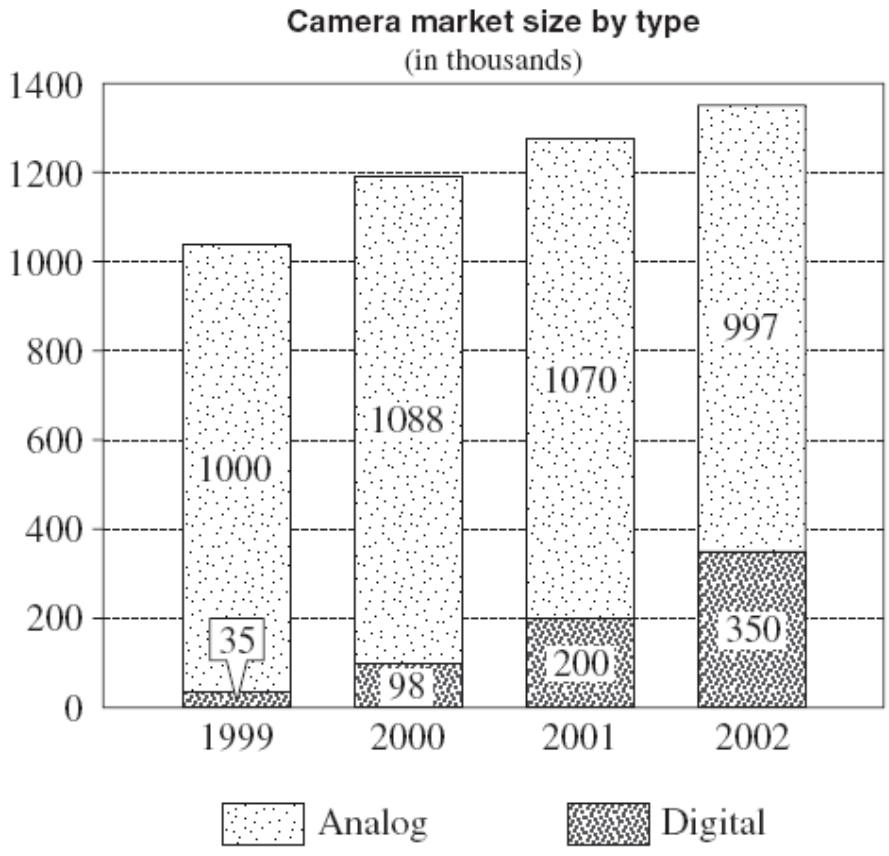
$T = 2 \times 3^{4-1}$
$= 2 \times 3^3$
$= 54$

Section II
Total marks (78)
Attempt Questions 23-28
Allow about 2 hours for this section
Start each question on a SEPARATE page/ booklet.

All necessary working should be shown in every question

Question 23 (13 marks) Use a separate page/ booklet **Marks**

(a) The graph below shows the numbers of the two major types of cameras, analogue and digital, sold in Australia in the years 1999–2002.



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In 2001, what percentage of the cameras sold were digital cameras? (To the nearest per cent.) $\frac{200}{1270} \times 100 = 16\%$ **2**

(b) At the recent school athletics carnival Joseph helped set up the shot-put competition.

(i) In a box he had two $2\frac{1}{4}$ kg shot-put, three $2\frac{3}{8}$ kg shot-put and one $2\frac{5}{8}$ kg shot-put.
Calculate the total weight of the six shot-puts. $14\frac{1}{4}$ **1**

(ii) In this event the contestants choose the weight of the shot-put they throw. Their points are determined by multiplying the weight of the shot-put in Kilograms by the distance they throw the shot-put in metres.

Dale threw the $2\frac{5}{8}$ kg shot-put a distance of $8\frac{1}{2}$ metres.

Carla threw the $2\frac{1}{4}$ kg shot-put a distance of $10\frac{3}{4}$ metres.

How many points more than Dale did Carla score in this event? **2**

$\frac{357}{16} = 22\frac{5}{16}$

$\frac{387}{16} \Rightarrow \frac{30}{16} = 1\frac{7}{8}$

(c) The table below shows the monthly repayment on a loan of $1000.

	Interest rate (p.a.)			
Term	**9%**	**10%**	**11%**	**12%**
10 years	$12.67	$13.22	$13.78	$14.35
15 years	$10.14	$10.75	$11.37	$12.00
20 years	$9.00	$9.65	$10.32	$11.01
25 years	$8.39	$9.09	$9.80	$10.53

Mr. and Mrs. Riley borrow $225 000 to be repaid over 20 years at 10% p.a. compounded annually

Calculate the amount of interest that they pay on the loan **3**

Repmnts $= 9.65 \times 225 = \$2171.25$

$2171.25 \times 20 \times 12 = \$521100$

$I = 521100 - 225000$

$\$296100$

(d) When Pikachoo was 22 years old, she began planning for her retirement. Pikachoo planned to work for 35 years. She invested $1500 in an account that was paying 6.5% p.a. with interest compounded annually.

(i) Find the amount to which this $1500 will grow after 35 years. **1**

$A = 1500(1.065)^{35} = \$13593.38$

(ii) At the end of each year, Pikachoo adds a further $1500 to the investment to form an annuity. Find the future value of the annuity at the end of 35 years. **2**

$A = 1500\left[\frac{1.065^{35}-1}{0.065}\right]$

$= \$186052.04$

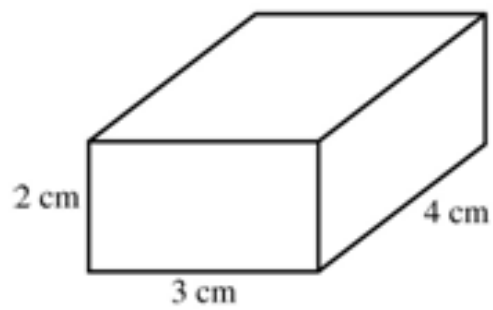
(iii) What single investment could be made at the beginning of the 35-year period that will have the same value at the end of 35 years? **2**

$N = 1500\left[\frac{1.065^{n}-1}{0.065(1.065)^{35}}\right]$

$= \$20530.44$

Question 24 (13 marks) Use a separate page/ booklet **Marks**

(a) Calculate the volume of the box:



$V = 2 \times 3 \times 4$
$= 24 cm^3$.

1

(b) Five balls, each with a diameter of 4 cm are placed inside a cylinder. Calculate the least amount of unused space inside the cylinder $Space = \pi(2)^2 \times 20 - 4 \times \frac{4}{3}\pi(2)^3$
$= 117.29 cm^2$ **3**

(c) The ages of a group of junior architects joining an international firm are indicated on the stem-and-leaf plot below.

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

Calculate the mean age 29.15

2

(d) The cost (C) of renting a car from A1 CAR RENTALS is \$40 plus 50c per kilometre (k) driven.

i) Write an algebraic expression for the cost C in terms of k. $C = 40 + 0.5k$ **1**

ii) The cost of a rental car is \$150. Write an equation and solve it for k to find the distance travelled in the rental car. **2**
$150 = 40 + 0.5k$
$110 = 0.5k \Rightarrow 220 km$

(e) Theo invests a sum of money in an account at an interest rate of 7.5% per annum. The time taken, *n*, for Theo's investment to double in value can be found by solving the equation $(1.075)^n = 2$.

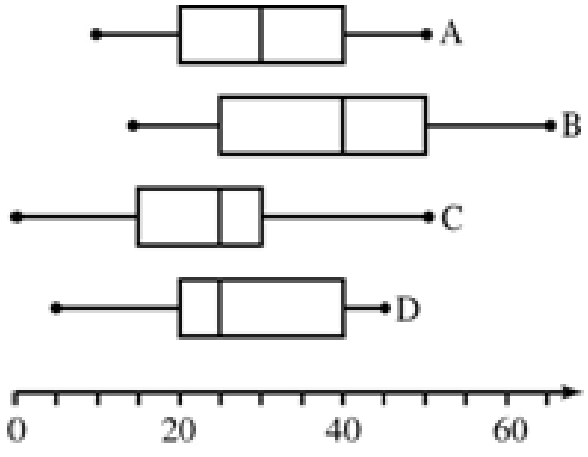
i) Use the method of substitution to find the solution to this equation, correct to the nearest whole number. **2**

Subst $n = 6 : = 1.54$; $n = 12 : \Rightarrow 2.38...$ $\therefore n = 10 \Rightarrow 2.06$ $\therefore n = 10$

ii) Write an equation that when solved will determine the length of time for an amount of money to treble when invested at 15% per annum. (Do not actually solve the equation.) **1**

$(1.15)^n = 3$

(f) Examine the following diagram.



Which box and whisker plot shows the smallest interquartile range? C

1

Question 25 (13 marks) Use a separate page/ booklet **Marks**

(a) The time taken, in seconds, for 10 boys and 10 girls to swim 100 metres is shown below.

Boys 71.2 71.4 71.3 72.0 71.7 71.5 71.4 72.8 72.1 71.9

Girls 71.6 70.9 72.2 72.1 72.2 72.4 72.0 72.7 72.2 72.1

(i) Display this information in a back-to-back stem-and-leaf plot. **3**

(ii) Find the median of each data set. **2**

G: Median = 72·15
B: Median = 71·6

(iii) Find the range and interquartile range of each data set. **4**

G: IQR = 72·2 − 72·0 = 0·2 Range = 1·8 B: IQR = 72·0 − 71·4 = 0·6 Range = 1·6

(iv) Display both sets of data using a box-and-whisker plot. **3**

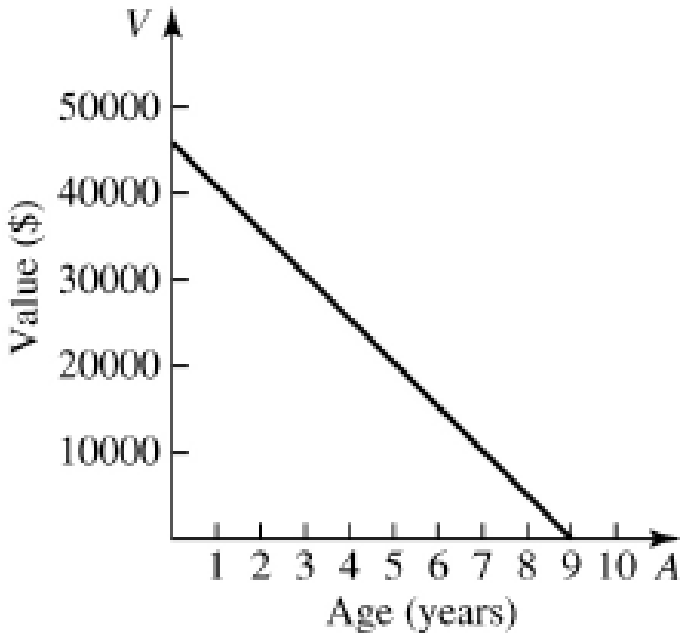
(v) "Generally boys can swim 100 metres in a quicker time than girls." Using the results obtained either reject or accept this statement, giving reasons for your answer. **1**

GIRLS		BOYS
9	70*	
	71	2 3 4 4
6	71*	5 7 9
4 2 2 2 1 1 0	72	0 1
7	72*	8

Accept - boys have lower median
75% of boys faster than 75% of girls

Question 26 (13 marks) Use a separate page/ booklet **Marks**

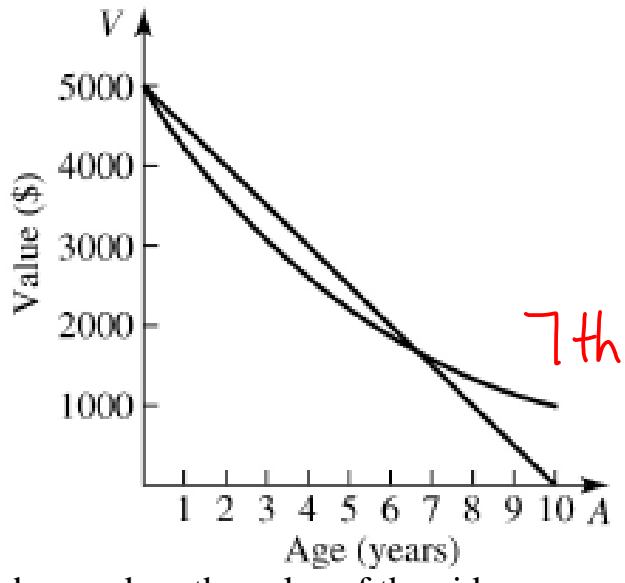
(a) The graph below shows the depreciating value of a car. After how many years can the car be written off?



9 years

1

(b) The graph below shows the depreciation of a video camera under both straight-line and declining-balance depreciation.



7th year

In which year does the value of the video camera under declining-balance depreciation first exceed the value under straight-line depreciation?

1

(c) Express $P = \dfrac{3Q-2}{5}$ with Q the subject

$P = \dfrac{3Q-2}{5}$

$5P = 3Q - 2$

$\dfrac{5P+2}{3} = Q$

2

(d) In spite of Federal Government legislation, at a school, a Mars Bar machine is installed for a 4-week trial period. The number of Mars Bars sold each day is shown below.

22	27	19	15	1
20	19	30	34	21
16	14	12	18	11
25	16	22	24	31

(i) Find the standard deviation of the data set. Explain your choice of population or sample standard deviation. **2**

$\sigma_n = 7.485151969$ ⇐ Population deviation as whole school.

(ii) Complete the frequency distribution table on page **20** **3**

(iii) On the grid provided on page **21**, draw a cumulative frequency histogram and polygon for the data. **2**

(iv) Use your graph to estimate the median of the distribution. **1**

(v) Use the graph to estimate the interquartile range of the distribution. **1**

Question 27 (13 marks) Use a separate page/ booklet **Marks**

(a) A test is developed to detect for bird flu. The validity of the test is trialled on a group of chickens, some of which are known to be infected with bird flu, while the rest are known not to have bird flu. The results are shown in the table below.

	Test results		
	Accurate	Not accurate	TOTAL
Number of chickens with bird flu	48	2	50
Number of chickens without bird flu	135	15	150
TOTAL	183	17	

(i) How many chickens were tested? 200 **1**

(ii) What percentage of the test results were accurate? $\frac{183}{200} \times 100\% = 91.2\%$ **2**

(b) The expression $r = \sqrt[3]{\frac{3V}{4\pi}}$ is used to calculate the radius of a sphere given the volume. Calculate the radius of the sphere with a volume of 1000 cm^3. (answer to 1 decimal place)

$r = \sqrt{\frac{3000}{4\pi}} = 15.5$ **2**

(c) Simplify the following

i) $4x - 5y - 7x + 8y$ $= 3y - 3x$ **1**

ii) $8(2x-3) - 9(x+5)$ $= 16x - 24 - 9x - 45$
$= 7x - 21$ **2**

d) Describe the shape of the following distribution

Stem	*Leaf*
21	0
22	
23	2 3 4 9
24	6 7 8 8 9 9
25	0 1 2 3 4 6 7 9 9

Key: 23|2 = 23.2

Negatively skewed

1

e) Gabrielle produces dresses for a department store. Her profit is given by the equation $P = 30n - 2000$, where P is the profit and n is the number of dresses sold.

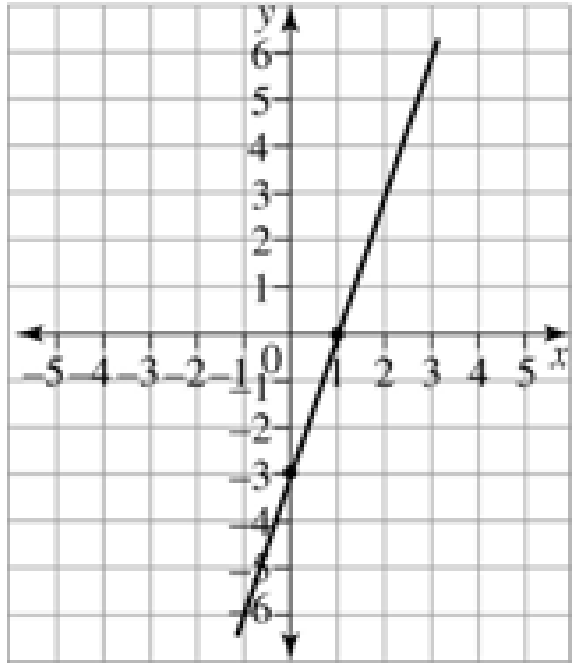
i) How much profit does she make when she sells 150 dresses?

$P = 30 \times 150 - 2000 = \$2500$ **1**

ii) Calculate the minimum number of dresses that Gabrielle must sell in order to make a profit

$0 = 30 \times n - 2000$
$2000 = 30n$
$67 = n$ **2**

f) What is the equation for this linear graph?



$y = 3x - 3$

Question 28 (13 marks) Use a separate page/ booklet **Marks**

(a) Solve the equation: $\frac{3p-3}{4} = \frac{3+5p}{6}$. $6(3p-3) = 4(3+5p)$ $18p-18 = 12+20p$ $-6 = 2p$ $-3 = p$ **3**

(b) Ian works 2 hours everyday of the week. His hourly rate is \$19.14, and he is paid time and a half on Saturday and double time on Sunday. Calculate how much Ian earns in one week. **3**

$P = 2\times5\times19.14 + 2\times1.5\times19.14 + 2\times2\times19.14$
$= \$325.38$

(c) (answer by choosing A,B,C or D)

A television current affairs program conducts a poll asking the following question.

> *'Do you think that the government should increase the amount of dole payments?'*
>
> YES: 1902 111 111
> NO: 1902 222 222
>
> *Call costs \$1.10 inc GST, higher from public and mobile phones

Which of the following statements is correct?

A The question itself is free of bias.
B The survey will be biased because only viewers of this program will call.
C The survey will be biased because those who support this statement may be unable to afford the call cost.
D All of the above statements are correct.

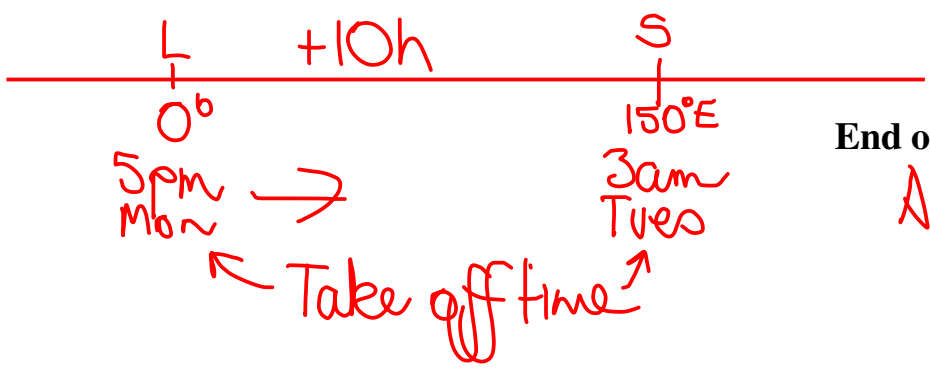
1

(d) Jack takes out an \$80 000 loan to be repaid over a 10-year term at an interest rate of 12% p.a. reducible interest. Calculate the amount of each monthly repayment **3**

$80000 = M\left[\frac{1.01^{120}-1}{0.01\times1.01^{120}}\right]$ $M = 80000\left[\frac{0.01\times1.01^{120}}{1.01^{120}-1}\right] = \$1147.77$

(e) An aircraft flies from London (0°) to Sydney (150°E). The flight takes 26 hours. The aircraft leaves London at 5 pm (London time) on Monday.

What is the day and time in Sydney when the aircraft arrives? (both cities are on standard time) **3**



London =

End of Paper

Arrival time = 3am Tues + 26hrs

= 5am Wed.

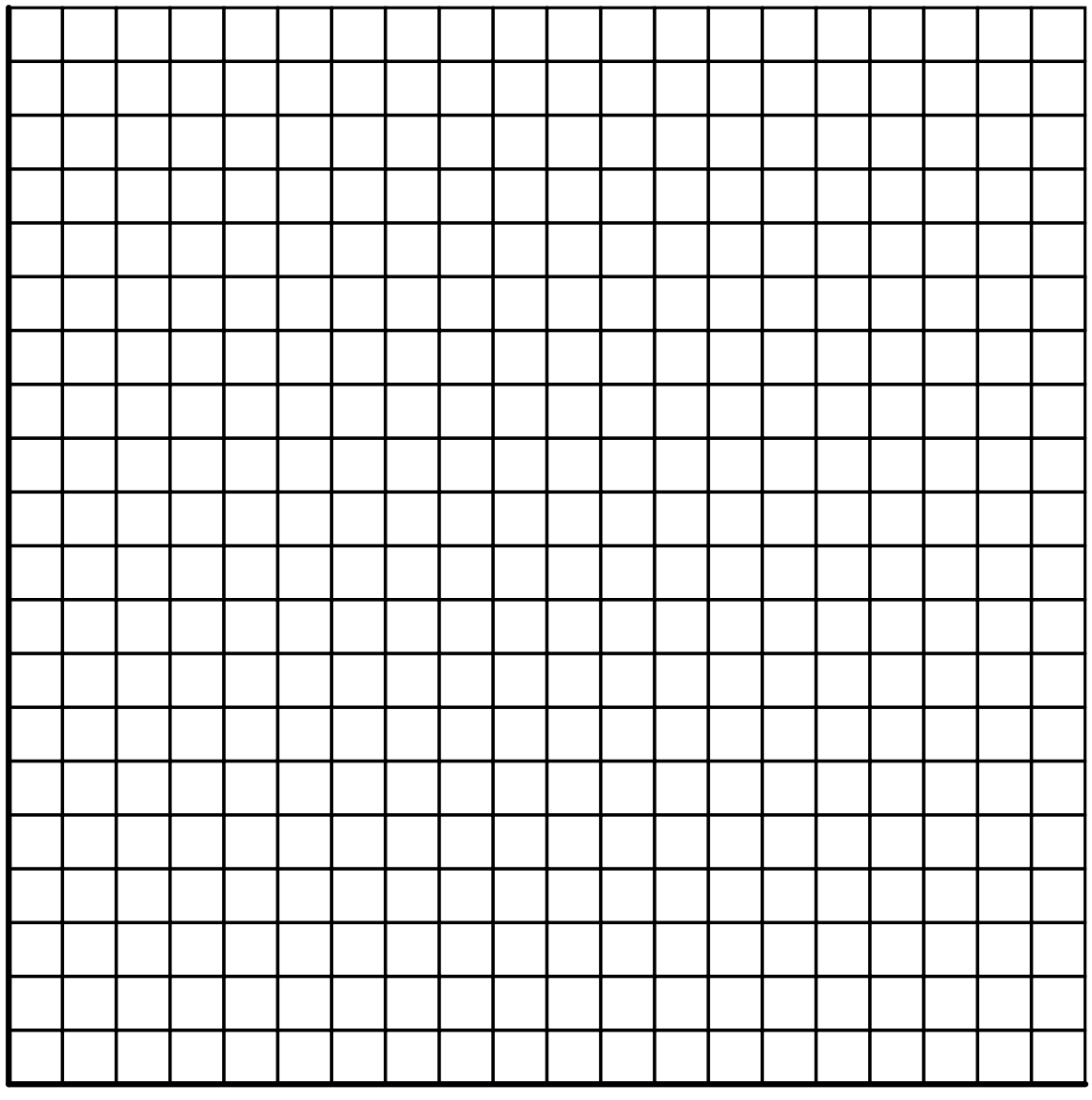
Please remove this page and attach it to your answer for Question 26.

Frequency distribution table for Question 26(d)(ii)

Class	***Class centre***	***Tally***	***Frequency***	***Cumulative frequency***
0 – 4				
5 – 9				
10 – 14				
15 – 19				
20 – 24				
25 – 29				
30 – 35				

Please remove this page and attach it to your answer for Question 26

Use the grid below to answer Question 26(d)(iii)



Centre Number

Student Number

YEAR 12

GENERAL MATHEMATICS-MULTIPLE CHOICE ANSWER SHEET

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 this by writing the word *correct* and drawing an arrow as follows

correct

(A) ⬭ (B) ⬬ (C) ⬬ (D) ⬭

ATTEMPT ALL QUESTIONS

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) ⬭