Name .....

THE KING'S SCHOOL

August 2017
Preliminary Course
Assessment Task 3 (PAT3)

Mathematics General Year 11

(80 marks)

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using black pen.
- Draw diagrams using pencil.
- Board-approved calculators may be used.
- A Formulae and Data Sheet is provided separately.
- Show all necessary working in Questions 21-24.

SETTER/CHECKER: KBS/SLO

Section I

(20 marks)

- Attempt Questions 1-20.
- Allow about 30 minutes for this section.
- Answer on the multiple choice answer sheet provided.
- Answer, using **2B lead pencil** only

Section II

(60 marks)

- Attempt Questions 21 to 24.
- Allow about 90 minutes for this section.
- Write answers in the spaces provided.
- Write, using **black pen** only.

Examiners' Use Only

Question	*Algebra and Modelling*	*Data and Statistics*	*Financial Mathematics*	*Measurement*	*Probability*	*Total*
1-20	9, 13, 15, 18, 19 / 5	6, 7, 11, 16 / 4	4, 8, 14 / 3	1, 3, 5, 10, 12, 17 / 6	2, 20 /2	/20
21	d, f / 5	b / 2	a, g / 5	c, e / 3		/15
22		c, e / 4	d / 4	b / 3	a / 4	/15
23	c, e / 2	a, b /10		d / 3		/15
24	c, d, e / 8	a / 3	b / 2	f / 2		/15
Total	/20	/23	/14	/17	/6	/80

Section I

20 marks
Attempt Questions 1 - 20
Allow about 30 minutes for this section

Use the multiple-choice answer sheet for Questions 1-20

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1 Which of the following is equivalent to the number 7.25×10^4?

(A) 0.000725

(B) 7 250

(C) 29 000

(D) 72 500

2 Darcy bought a red, a blue and a green folder. He wants to display them on a book shelf. How many ways can these folders be displayed on the book shelf?

(A) 1

(B) 3

(C) 6

(D) 9

3 An offset survey was taken of a piece of land. The field book entry is shown below and all measurements are in metres.

		D		
		150		
C	70	110		
		75	30	*B*
		A		

What is the approximate length of *AB*?

(A) 30 m

(B) 69 m

(C) 75 m

(D) 81 m

4 Amy receives wages of $1 875 per month plus 4% commission on all her sales. What were her sales in a month if she received a total pay of $1 953?

(A) $878.00

(B) $1 946.88

(C) $1 950.00

(D) $2 190.12

5 How many megabits per second are there in 9 000 000 bits per second?

(A) 0.009

(B) 9

(C) 9 000 000

(D) 9 000 000 000

6 Which of the statements about the data below is correct?

7, 8, 10, 13, 13, 15

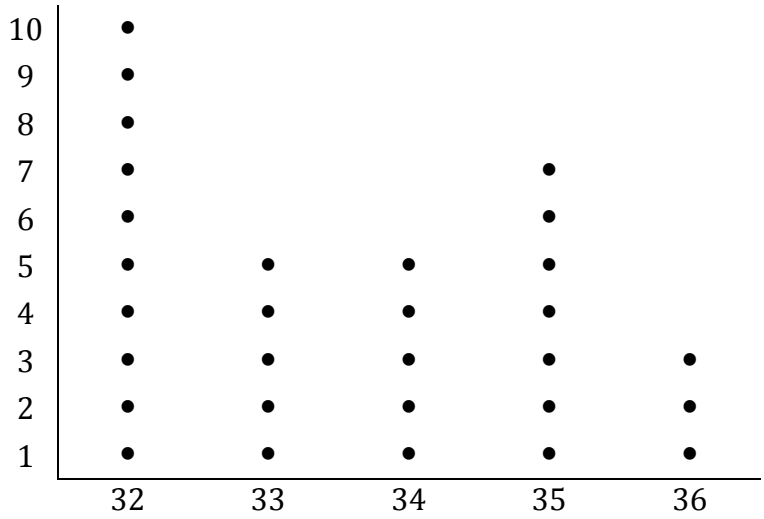
(A) The range is greater than the mode.

(B) The median is greater than the mode.

(C) The mean is greater than the range.

(D) 50% of the scores are greater than the mode.

7



What is the median score in the above dot plot?

(A) 32

(B) 33.5

(C) 34

(D) 36

8 Felix invests \$1600 at 8% p.a. compounding quarterly. How much interest will Felix receive in 3 years?

(A) \$415.54

(B) \$429.19

(C) \$2 015.54

(D) \$2 029.19

9 Which of the following equations has $x = 5$ as the solution?

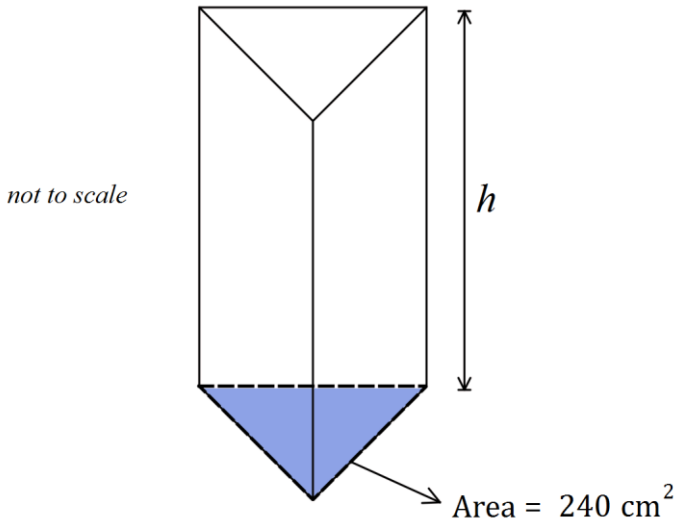
(A) $x - 5 = 10$

(B) $5 - x = 10$

(C) $\frac{x}{2} = 10$

(D) $2x = 10$

10 A container is in the shape of a triangular prism which has a capacity of 12 Litres. The area of the triangular base is 240 cm^2.



What is the distance, *h*, between the two triangular ends of the container?

(A) 5 cm

(B) 20 cm

(C) 25 cm

(D) 50 cm

11 Every fifth packet of yoghurt in the supermarket is checked for a *Use By Date.* What is this method of sampling?

(A) Census

(B) Random

(C) Stratified

(D) Systematic

12 Savannah makes 120 phone calls on her mobile phone each month. Which is the best deal for Savannah?

(A) Unlimited calls for $99 per month.

(B) $49 plan, where the first 50 calls are free and then the call cost is $0.75 per call.

(C) $0.90 per call, unlimited talk time.

(D) Prepaid card, where 120 calls are bought for $100.

13 Find the value of x given $a = 32$, $y = 2$ and the formula $a = 2xy^2$.

(A) 3

(B) 4

(C) 5

(D) 6

14 Phoebe needs $10 000 for a holiday in five years' time. She found an account that will earn $8% pa simple interest. What is the amount of money she needs to invest in this account to total $10 000 in five years' time?

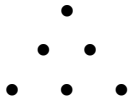
(A) $2 000

(B) $7 143

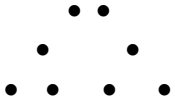
(C) $8 000

(D) $9 259

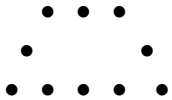
15 Dots were used to create a pattern. The first three shapes in the pattern are shown.



Shape 1



Shape 2



Shape 3

The number of dots used in each shape is recorded in the table.

Shape (S)	1	2	3
Number of Dots (N)	6	8	10

How many dots would be required for Shape 156?

(A) 316

(B) 520

(C) 624

(D) 936

16 Twenty students were asked how many hours of study they completed per week.

Hours per week	*Frequency*
0–4	5
5–9	10
10–14	3
15–19	2

What is the mean number of hours of study completed by the students per week?

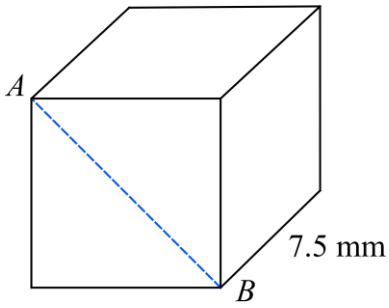
(A) 6.5

(B) 7.0

(C) 7.5

(D) 9.5

17 The cube below has a side length of 7.5 mm.



Not to scale

What is the length *AB*, correct to two decimal places?

(A) 7.50 mm

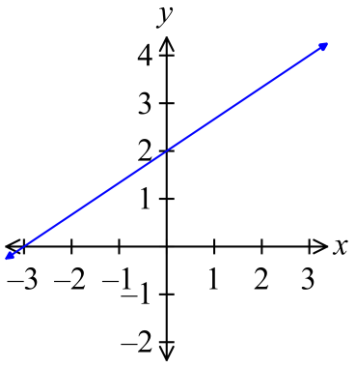
(B) 10.61 mm

(C) 13.25 mm

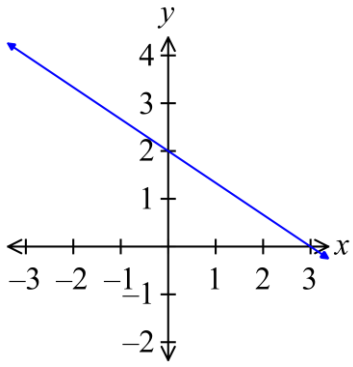
(D) 21.21 mm

18 Which of the following is the graph of $y = \frac{2}{3}x + 2$?

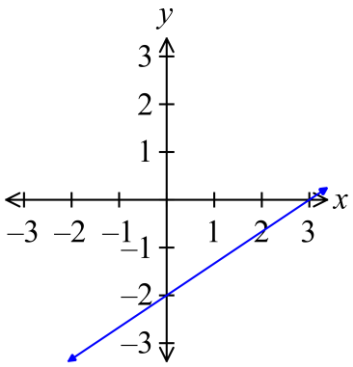
(A)



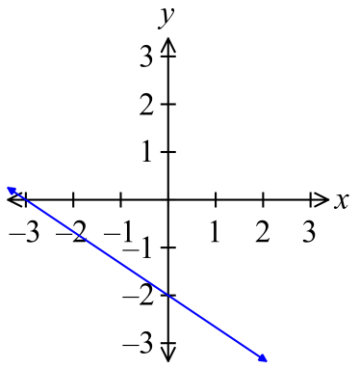
(B)



(C)



(D)



19 Simplify $2(x+4)-(x-3)$

(A) $x+1$

(B) $x+5$

(C) $x+7$

(D) $x+11$

20 A group of 485 people were surveyed. The people were asked whether or not they smoke. The results are recorded in the table. A person is selected at random from the group.

	Smokers	*Non Smokers*	*Total*
Male	88	176	264
Female	68	153	221
	156	329	485

What is the approximate probability that the person selected is a smoker **OR** is male?

(A) 33%

(B) 18%

(C) 68%

(D) 87%

End of Section I

Name .....

Section II
(60 marks)

- Attempt Questions 21-24
- Allow about 90 minutes for this section
- Write answers in the spaces provided.
- Write, using **black pen** only

Question 21 (15 marks) — Marks

(a) Millie invested $3 500 at 6.5% pa compounding annually for 4 years.

(i) How much does Millie have after 4 years? Answer to the nearest cent. **2**

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(ii) How much interest did Millie earn during the 4 years? **1**

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(b) The contents of 6 containers were weighed and recorded: 27g, 14g, 23g, 12g, 18g, 15g

What is the interquartile range? **2**

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(c) A phone call lasts for 2 minutes and 55 seconds. It costs 40 cents to connect and 25 cents per 30-second block or part thereof. How much does the call cost? **1**

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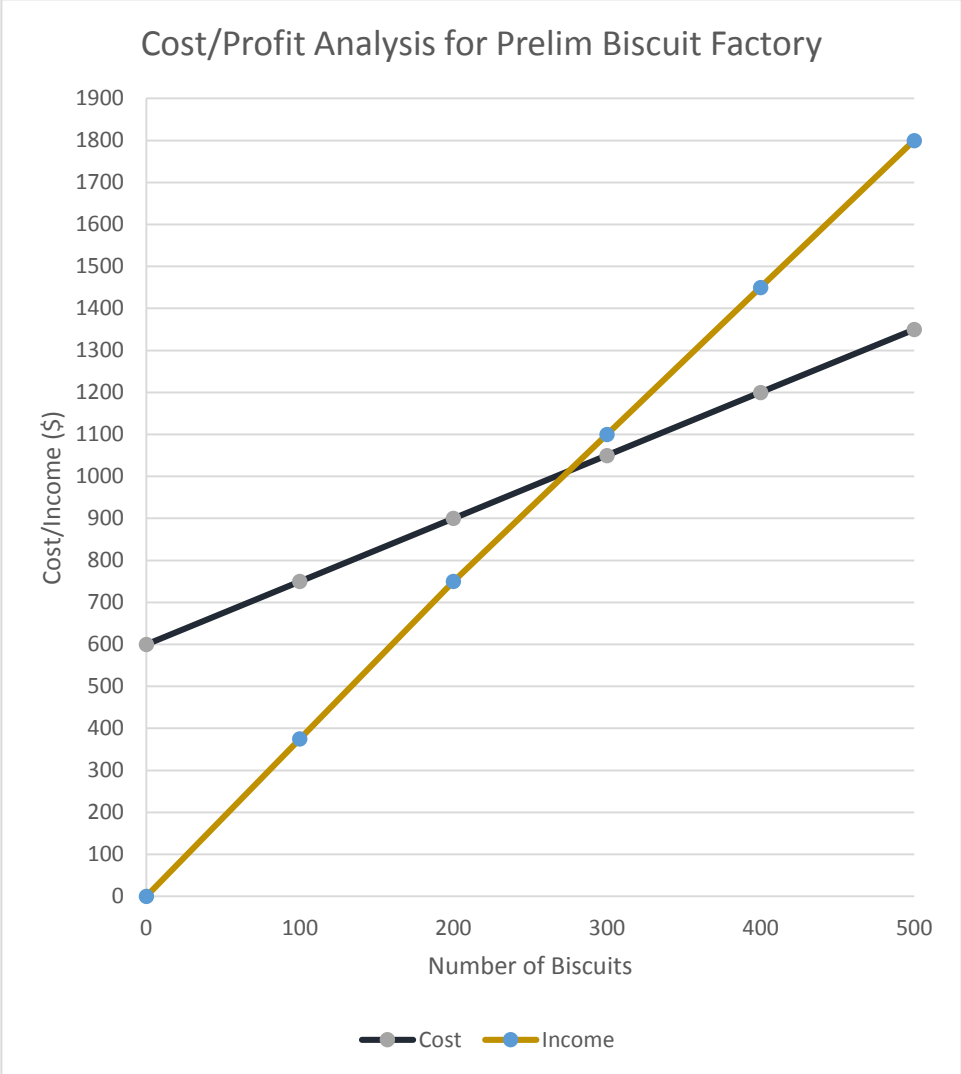
Question 21 continues on the next page

Name .....

Question 21 (continued) **Marks**

(d) Prelim Biscuit Factory bakes custom designed personalised biscuits for special occasions. Their cost/profit analysis is shown below.



(i) How many biscuits would they be able to bake for the cost of $750? **1**

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(ii) From the graph, what is an estimate for the number of biscuits they need to sell to reach breakeven point? **1**

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Question 21 continues on the next page

Name .....

Question 21 (continued) **Marks**

(iii) What amount, to the nearest \$50, would their profit be if they only sell 400 biscuits? **1**

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(e) Gabriel has 32 GB of data storage on a USB drive? How many data files of average size 6.4 MB can he store? **2**

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(f) Solve $\frac{x}{3} - 5 = \frac{3x}{4}$ **2**

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(g) Michelle invested \$4 000 at 5% pa simple interest. How many years will it take for her investment to double its value? **2**

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End of Question 21

Name .....

Question 22 (15 marks) **Marks**

(a) The numbers 1 to 20 are written on identical cards which are then shuffled and placed face down on a table.

(i) One card is selected at random and turned up and the number recorded. What is the probability that the card was:

(α) the number 15? **1**

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(β) even? **1**

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(γ) **NOT** divisible by 3? **1**

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(ii) Three cards are chosen at random and placed on a table. How many different numbers can be made from these three cards? **1**

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(b) In a 100 m freestyle swimming race the winning time was 48.92 seconds.

(i) What is the percentage error in this time? Answer correct to 3 decimal places. **2**

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(ii) Calculate the speed, in metres per second, correct to three decimal places. **1**

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Question 22 continues on the next page

Name .....

Question 22 (continued) **Marks**

(c) A music album stores data about its content. Classify the following data as either:

- Categorical (nominal)
- Categorical (ordinal)
- Quantitative (discrete)
- Quantitative (continuous)

(i) Title of the music album. **1**

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(ii) Number of songs on the music album. **1**

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(iii) Total playing time for each song on the music album. **1**

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(d) Ebony earns $17.20 per hour at the normal rate. Each week, Ebony works for 11 hours at the normal rate and 4 hours at time-and-a-half.

(i) What is Ebony's wage, per week? **1**

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(ii) Ebony wants to increase her weekly wage in part (i) to $430 by working extra hours at the normal rate. How many extra hours must she work? **2**

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(iii) Ebony's hourly rate is increased by 5%. Find the new hourly rate for normal hours. **1**

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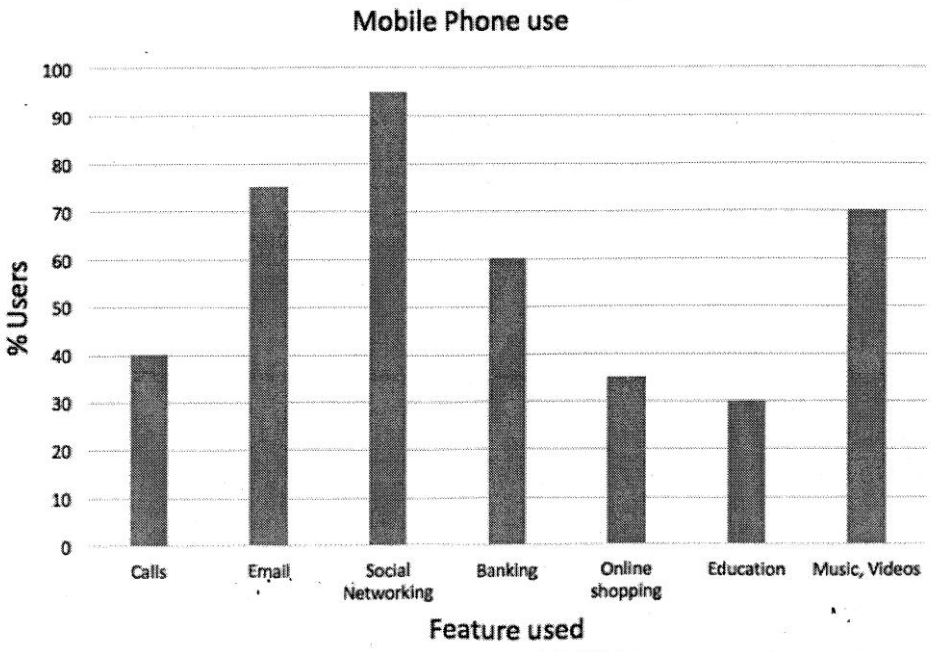
Question 22 continues on the next page

Name .....

Question 22 (continued) **Marks**

(e) 500 mobile phone users have been surveyed on the way they use their mobile phones. The results were summarised and are presented in the graph below.



How many people indicated that they use their mobile phones for banking? **1**

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End of Question 22

Name .....

Question 23 (15 marks) **Marks**

(a) The back-to-back stem-and-leaf plot below shows the times, to the nearest minute, of the latest 11 calls on the mobile phone bills for Jacklyn and Kate respectively.

Jacklyn					*Kate*		
6	5	5	4	0	2		
	2	2	1	1	5	5	
		7	3	2	4	7	
			5	3	2	4	5
			2	4	0	6	
				5			
				6	8		

(i) Determine the standard deviation of Kate's calls, correct to two decimal places. **1**

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(ii) What is the median call time for Kate? **1**

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(iii) What percentage of Jacklyn's calls are less than the median length of Kate's calls, to the nearest whole number? **1**

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(iv) Describe the skewness of Jacklyn's call times. **1**

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Question 23 continues on the next page

Name .....

Question 23 (continued) **Marks**

(b) The height, in centimetres, of 20 students is recorded below.

Height Range (cm)	*Class Centre (x)*	*Frequency (f)*	$f \times x$
140-149		2	
150-159		8	
160-169		6	
170-179		3	
180-189		1	

(i) Complete the table by finding the class centres and filling in the $f \times x$ column. **2**

(ii) Determine the mean height. **2**

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(iii) What is the modal class? **1**

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(iv) What percentage of students is in the 150-159 class? **1**

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Question 23 continues on the next page

Name .....

Question 23 (continued) **Marks**

(c) Solve the equation $3y + 7 = 52$ **1**

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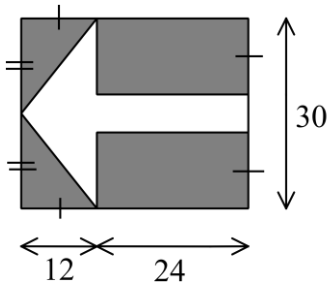
(d)



Not to scale

(i) Find the shaded area of this sign. All measurements are in centimetres. **2**

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(ii) What percentage of the rectangular sign does the arrow cover? **1**

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Question 23 continues on the next page

Name .....

Question 23 (continued) **Marks**

(e) Simplify $\frac{4x}{5y} \div \frac{x}{20y}$ **1**

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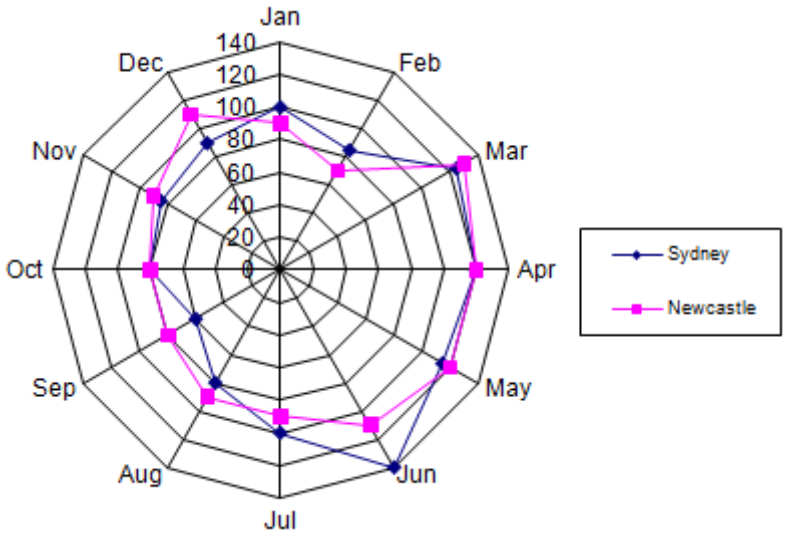
End of Question 23

Name .....

Question 24 (15 marks) **Marks**

(a) The radar chart shows the average rainfall (mm) for Sydney and Newcastle.



(i) What was Newcastle's average rainfall in May? **1**

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(ii) In which months did Sydney and Newcastle have the same rainfall? **1**

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(iii) What was the range in the average rainfall for Sydney? **1**

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Question 24 continues on the next page

Name .....

Question 24 (continued) **Marks**

(b) A used car is for sale at \$15 000. Finance is available at \$5 000 deposit and monthly repayments of \$520 for 4 years. What is the interest paid? **2**

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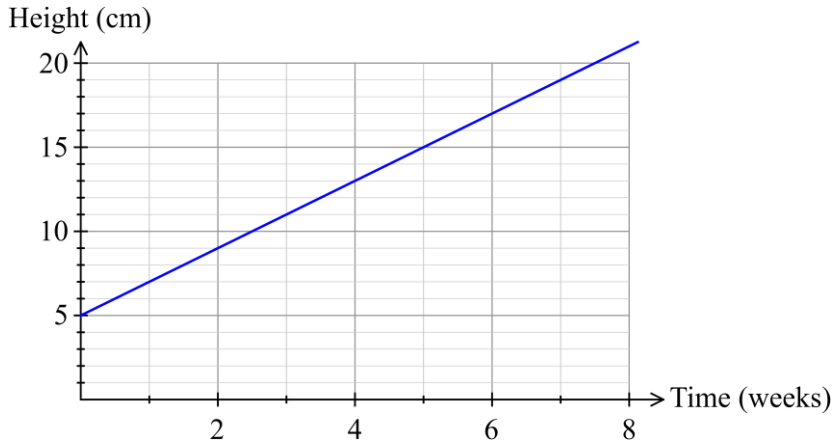
Question 24 continues on the next page

Name .....

Question 24 (continued) **Marks**

(c) The graph below shows a plant's growth over an eight-week period.



(i) How tall was the plant after 5 weeks? **1**

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(ii) When did the plant have a height of 17 cm? **1**

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(iii) What is the gradient of the straight-line graph? **1**

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(iv) Write an equation to represent the plant's growth using h for the height of the plant and t for the time. **1**

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Question 24 continues on the next page

Name .....

Question 24 (continued) **Marks**

(d) Find a linear equation that represents the relationship between x and y in the table. **2**

x	0	2	4	6	8
y	1	2	3	4	5

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(e) Solve $\frac{5a}{2}+1=\frac{2a}{3}-10$ **2**

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(f) It takes Dan 5 minutes 25 seconds to download a music file which is 3.9 MB in size. Calculate Dan's download speed to the nearest Kb per second. **2**

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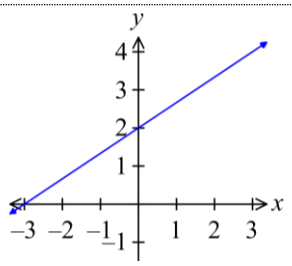
End of Examination Paper

The King's School
Year 11 Mathematics General
Preliminary Course Examination, August 2017
Worked Solutions and Marking Guidelines

SECTION I		
	Solution	**Criteria**
1	$7.25 \times 10^4 = 7.25 \times 10{,}000$ $= 72{,}500$	1 mark: D
2	Number of outcomes $= 3 \times 2 \times 1$ $= 6$	1 mark: C
3	$AB = \sqrt{75^2 + 30^2}$ $= 80.77747211... \approx 81$ m	1 mark: D
4	$\$1875 + 0.04 \times x = \$1953$ $x = \dfrac{\$78}{0.04} = \$1950$	1 mark: C
5	$9{,}000{,}000$ bps $= 9{,}000{,}000 \div 1{,}000{,}000$ Mbps $= 9$ Mbps	1 mark: B
6	Median = 11.5, Mode = 13 Mean $= \dfrac{\text{Sum of scores}}{\text{Number of scores}} = \dfrac{66}{6} = 11$, Range $= 15 - 7 = 8$ The mean is greater than the range.	1 mark: C
7	There are 30 scores. The median is the average of the 15th and 16th score. Median is 33.5	1 mark: B
8	$A = \$1600 \times \left(1 + \dfrac{0.08}{4}\right)^{12}$ $= \$2029.19$ $I = \$2029.19 - \$1600$ $= \$429.19$	1 mark: B
9	2(5) = 10	1 mark: D
10	$V = ah$ $12\,000 = 240 \times h$ $\therefore \quad h = 50$ ***cm***	1 mark: D
11	Every 5th packet is a structured sample size. Systematic sample.	1 mark: D
12	A Monthly charge is \$99 B Monthly charge $= \$49 + (70 \times \$0.75) = \$101.50$ C Monthly charge $= 120 \times \$0.90 = \$108$ D Monthly charge is \$100	1 mark: A

SECTION I		
	Solution	**Criteria**
13	$a = 2xy^2$ $32 = 2 \times x \times 2^2$ $x = \frac{32}{2 \times 2^2} = 4$	1 mark: B
14	$I = Prn$ $\quad A = P + I$ $= P \times 0.08 \times 5$ $\quad \$10,000 = P + P \times 0.4$ $= P \times 0.4$ $\quad = 1.4P$ $P = \frac{\$10,000}{1.4} \approx \$7143$ Alternatively, calculate A using each of the answers.	1 mark: B
15	$N = 2S + 4$ $N = 2(156) + 4$ $N = 316$	1 mark: A
16	$\text{Mean} = \frac{2 \times 5 + 7 \times 10 + 12 \times 3 + 17 \times 2}{20}$ $= 7.5$	1 mark: C
17	Pythagoras theorem (all sides are 7.5 mm) $AB^2 = 7.5^2 + 7.5^2$ $AB = 10.60660172...10.61$ mm	1 mark: B
18	Gradient is $\frac{2}{3}$ y-intercept is 2 	1 mark: A
19	$2(x + 4) - (x - 3) = 2x + 8 - x + 3$ $= x + 11$	1 mark: D
20	$\left(\frac{68 + 88 + 176}{485}\right) \times 100 = 68.5\%$	1 mark: C

End of Section I

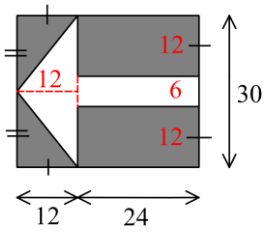
Section II		
	Solution	**Criteria**
21(a) (i)	$A = P(1+r)^n$ $= \$3500(1+0.065)^4$ $= \$4502.632227\ldots$ $= \$4502.63$ Millie has \$4502.63 after 4 years.	2 marks: Correct answer. 1 mark: Uses the CI formula with at least 1 correct value.
21(a) (ii)	$I = A - P$ $= 4502.63 - 3500$ $= \$1002.63$ Millie earns \$1002.63 in interest.	1 mark: Correct answer.
21(b)	Order the weights: 12g, 14g, 15g, |18g, 23g, 27g IQR $= Q_3 - Q_1$ $= 23 - 14 = 9$ g	2 marks: Correct answer. 1 mark: Orders the weights.
21(c)	There are 6 lots of 30-second blocks in 2 min and 55 s. Call charge $= \$0.40 + 6 \times \$0.25$ $= \$1.90$	1 mark: Correct answer.
21(d) (i)	100 biscuits	1 mark: Correct answer.
21(d) (ii)	Any answer between 260 and 290	1 mark: Correct answer.
21(d) (iii)	\$1 450 – \$1 200 = \$250	1 mark: Correct answer.
21(e)	Data files $= \dfrac{32 \times 1024}{6.4}$ $= 5120$ Gabriel can store 5120 data files on his USB drive.	2 marks: Correct answer. 1 mark: Shows some understanding.
21(f)	$4x - 60 = 9x$ $-60 = 5x$ $\therefore \quad x = -12$	2 marks: Correct answer. 1 mark: progressive
21(g)	$4\,000 = 4\,000 \times 0.05N$ $\therefore \quad N = 20$ years	2 marks: Correct answer. 1 mark: progressive

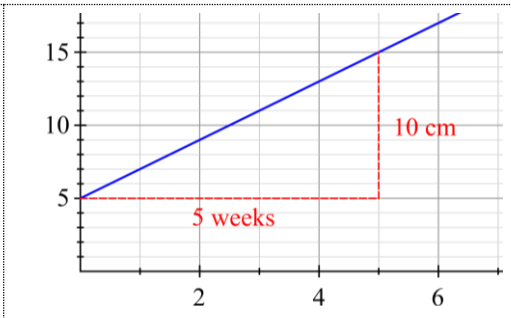
Section II		
	Solution	**Criteria**
22(a)(α)	$P(15) = \frac{1}{20}$	1 mark: Correct answer.
22(a)(β)	$P(\text{even}) = \frac{10}{20} = \frac{1}{2}$	1 mark: Correct answer.
22(a)(γ)	$1 - \frac{6}{20} = \frac{7}{10}$	1 mark: Correct answer.
22(a)(ii)	3 x 2 x 1 = 6	1 mark: Correct answer.
22(b) (i)	Limit of reading is 0.01 s Absolute error is 0.005 s $\text{Percentage error} = \frac{0.005}{48.92} \times 100$ $\approx 0.010\%$	2 marks: Correct answer. 1 mark: Calculates the absolute error
22(b))	$\text{Speed} = \frac{100}{48.92}$ $= 2.04415371$ ≈ 2.044 m/s	1 mark: Correct answer.
22(c) (i)	Categorical nominal data (name with no order)	1 mark: Correct answer.
22(c) (ii)	Quantitative discrete data (exact whole number)	1 mark: Correct answer.
22(c) (iii)	Quantitative continuous data (numerical measurement)	1 mark: Correct answer.
22(d) (i)	$\text{Wage} = 11 \times \$17.20 + 4 \times 1.5 \times \$17.20$ $= \$292.40$	1 mark: Correct answer.
22(d) (ii)	Let the number of extra hours be x $\$292.40 + x \times \$17.20 = \$430$ $17.20x = \$137.60$ $x = 8$ Ebony needs to work an extra 8 hours.	2 marks: Correct answer. 1 mark: Shows some understanding of the problem.
22(d) (iii)	$\text{New wage rate} = 1.05 \times \$17.20$ $= \$18.06$	1 mark: Correct answer.
22(e)	$22e = 60\% \times 500 = 300$	1 mark: Correct answer.

Section II

	Solution	Criteria
23(a) (i)	$\sigma = 16.84$	1 mark: Correct answer.
23(a) (ii)	32	1 mark: Uses the correct row.
23(a) (iii)	$\frac{9}{11} \times 100 = 82\%$	1 mark: Correct answer.
23(a) (iv)	Positive skew	1 mark: correct answer
23(b) (i)		2 marks: Correct answer. 1 mark: Finds class centre or *fx* column.
23(b) (ii)	$\bar{x} = \frac{\sum fx}{\sum f}$ $= \frac{3220}{20}$ $= 161$	2 marks: Correct answer. 1 mark: Calculates total of *f* or *f* × *x* column.
23(b) (iii)	Modal class is 150-159.	1 mark: Correct answer.
23(b) (iv)	Percentage (150-159) $= \frac{8}{20} \times 100 = 40\%$	1 mark: Correct answer.
23(c)	$3y + 7 = 52$ $3y = 45$ or $y = 15$	1 mark: Correct answer.
23(d) (i)	Area of the outside rectangle $A = lb = 36 \times 30 = 1080 \text{ cm}^2$ Area of the arrow $A = 24 \times 6 + \frac{1}{2} \times 30 \times 12 = 324 \text{ cm}^2$ Shaded area $= 1080 - 324 = 756 \text{ cm}^2$	2 marks: Correct answer. 1 mark: Shows some understanding of the problem.
23(d) (ii)	Percentage $= \frac{324}{1080} \times 100 = 30\%$	1 mark: Correct answer.
23(e)	$\frac{4x}{5y} \times \frac{20y}{x} = 16$	1 mark: Correct answer.

Height range	*x*	*f*	*f* × *x*
140-149	144.5	2	289
150-159	154.5	8	1236
160-169	164.5	6	987
170-179	174.5	3	523.5
180-189	184.5	1	184.5
	Total	20	3220



Section II		
	Solution	**Criteria**
24(a) (i)	Average rainfall in Newcastle in May is 120 mm.	1 mark: Correct answer.
24(a) (ii)	April and October.	1 mark: Correct answer.
24(a) (iii)	Range $= 140 - 60 = 80$ mm	1 mark: Correct answer.
24(b)	Total cost $= \$5000 + \$520 \times 12 \times 4$ $= \$29,960$ Interest paid $= \$29,960 - \$15,000$ $= \$14,960$	2 marks: Correct answer. 1 mark: Finds the total cost.
24(c) (i)	15 cm (from the graph)	1 mark: Correct answer.
24(c) (ii)	6 weeks (from the graph)	1 mark: Correct answer.
24(c) (iii)	$m = \frac{\text{Rise}}{\text{Run}}$ $= \frac{10}{5}$ $= 2$ Gradient of the line is 2. 	1 mark: Correct answer.
24(c) (iii)	Gradient is 2 and vertical-intercept is 5. $y = mx + b$ $h = 2t + 5$	1 mark: Correct answer.
24(d)	$y = \frac{1}{2}x + 1$	2 marks: Correct answer. 1 mark: either m or b correct
24(e)	$6 \times \left(\frac{5a}{2} + 1\right) = \left(\frac{2a}{3} - 10\right) \times 6$ $15a + 6 = 4a - 60$ $11a = -66$ $a = -6$	2 marks: Correct answer. 1 mark: Multiplies both sides of the equation by 6.
24(f)	$\frac{3.9 \times 1024 \times 1024 \times 8}{1000} = \frac{32715571.2}{1000}$ bits $= 3715.57$ kb $\therefore$ download $= \frac{32715.57}{5 \times 60 + 25}$ $= 101$ kbps	2 marks: Correct answer. 1 mark: correct k bits