Student Number _____

Teacher BM HK

Ascham School

2020
HSC TRIAL EXAMINATION
Monday August 3

Mathematics Standard 2

Writing time	2 hours 30 minutes
Reading time	10 minutes
Total Marks	100

General Instructions

- Write using black, non-erasable pen
- Diagrams must be drawn using pencil
- A NESA-approved calculator may be used
- All relevant working should be shown for each question

Additional Materials Needed

- Reference Sheet
- Multiple Choice Answer Sheet

Structure & Suggested Time Spent

- **Section I** (Multiple Choice) **15 Marks**
  Attempt all questions
  Allow about 20 minutes
- **Section II** (Extended Response) **85 Marks**
  Attempt all questions
  Answer in the space provided
  Allow about 2 hours and 10 minutes

Multiple Choice	Q16-28	Q29-42	Section II	TOTAL
/15			/85	/100

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Section I

15 marks
Attempt Questions 1-15
Allow about 25 minutes for this section

Use the multiple-choice answer sheet provided for Questions 1-15.

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 ○

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 have changed 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 ○

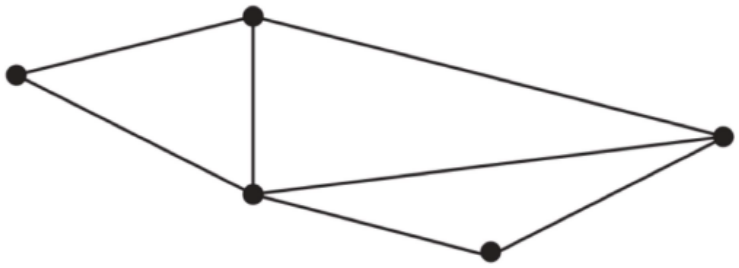
1 Which of the following is least affected by outliers?

(A) Range
(B) Mean
(C) Median
(D) Standard deviation

2 In the normal distribution, what is the probability that a score lies between 2 and 3 standard deviations above the mean?

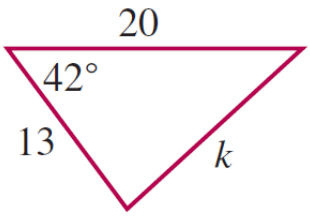
(A) 0.15%
(B) 2.35%
(C) 13.5%
(D) 34%

3 The number of vertices with an odd degree in the network below is:



(A) 1
(B) 2
(C) 3
(D) 4

4 What is the approximate length of the side marked with the letter k?



(A) 183
(B) 221
(C) 14
(D) 15

5 Which of the following relationships would most likely show a negative correlation?

(A) The distance travelled and the time taken to travel.
(B) The amount of money invested and the amount of interest earned.
(C) Average daily temperatures and the number of woollen jumpers sold.
(D) The distance walked and the number of calories burned.

Toby conducted a survey in his office about the number of left-handed and the number of right-handed colleagues he has and tabulated the results in a 2-way table.

	Male	Female
Left-handed	23	31
Right-handed	82	87

Use this information to answer questions 6 to 8.

6 How many people work in Toby's office?

(A) 54

(B) 169

(C) 223

(D) 118

7 If a person was chosen at random, what is the probability that they are a left-handed male?

(A) 22%

(B) 23%

(C) 10%

(D) 14%

8 If Toby's friend, Amy, wanted to use Toby's results in her office to estimate the number of right-handed colleagues she has, how many should she expect if she works in an office of 320 people?

(A) 165

(B) 169

(C) 155

(D) 243

9 A map has a scale of 1:400 000.
Two towns are 2.5 cm apart on the map.
What is the actual distance between the towns, in kilometres?

(A) 4 km

(B) 8 km

(C) 10 km

(D) 20 km

10 A scientist uses the capture-recapture technique to estimate the wild boar population on an island. In the first sample, she captures and tags 150 wild boar.
Some time later, she catches 60 tagged wild boar along with 180 untagged wild boar.

What is the approximate wild boar population on this island?

(A) 50

(B) 75

(C) 450

(D) 600

11 If $\cos\theta = -\frac{5}{7}$ and θ is obtuse, then θ correct to the nearest minute is:

(A) $44°25'$

(B) $135°35'$

(C) $157°25'$

(D) $144°35'$

12 Nicola bought a portfolio of 2000 PYC shares.
The value of each share is currently \$12.50, and Nicola is paid an annual dividend of \$0.75 per share. What is the dividend yield on the shares?

(A) 6%

(B) 6.25%

(C) 7.5%

(D) 12.5%

13 The scores $14, 23, 37$ and y have a mean of 32.5. What is the value of y?

(A) 47

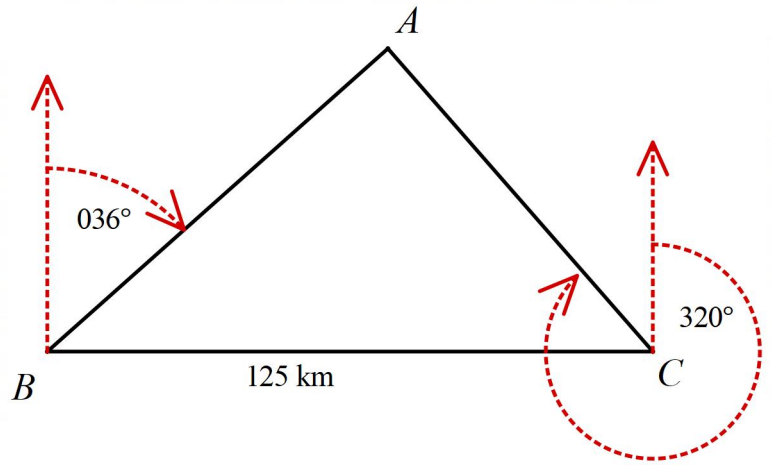
(B) 27

(C) 14

(D) 56

14 Town B is 125 km due west of town C.

Town A is on a bearing 036° from B and on a bearing 320° from C.



Which calculation could be used to find the distance from A to B?

(A) $AB = \dfrac{125 \sin 36^{\circ}}{\sin 320^{\circ}}$

(B) $AB = \dfrac{125 \sin 50^{\circ}}{\sin 54^{\circ}}$

(C) $AB = \dfrac{125 \sin 54^{\circ}}{\sin 76^{\circ}}$

(D) $AB = \dfrac{125 \sin 50^{\circ}}{\sin 76^{\circ}}$

15 What is the least amount (to the nearest dollar) that must be invested now at 3.6% per annum, compounded monthly, so that in three years it will have grown to \$48 000?

(A) \$42 997

(B) \$43 079

(C) \$43 093

(D) \$43 930

End of Section I

Section II

85 marks

Attempt all questions

Allow about 2 hours and 10 minutes for this section

Answer each question in the space provided.

Show all relevant working in questions involving calculations.

Marks

16 Lily buys an LCD television which is rated at 80 watts when being used for viewing.

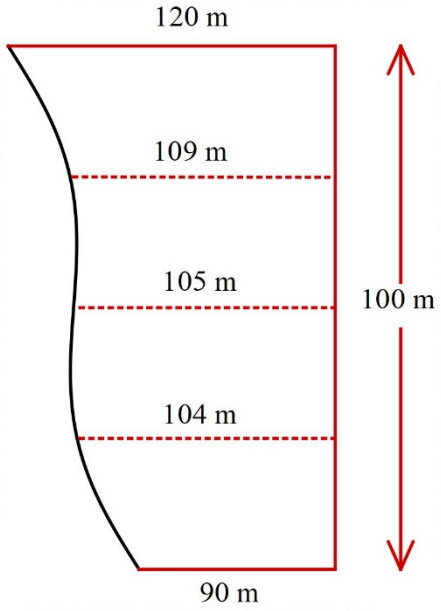
When in stand-by mode it is rated at 4 watts.

Lily and her family use the TV for viewing for 8 hours a day and leave it on standby for the remaining time.

a) Show that the TV uses 0.704 kilowatt hours of energy on an average day. **2**

b) Lily pays 30 cents per kWh for electricity. How much money would she save in a year if she turned the TV off when it wasn't being viewed, rather than leaving it on stand-by? **2**

17 The houses on Matt's side of the street are placed on the following blocks of land.



Use **two** applications of the Trapezoidal Rule to approximate the area of the land. **3**

18 A year ago, Mac Bank bought a new computer server for $15 200.

A year later its value had depreciated to $13 376.00 using the declining balance method.

a) What is the annual rate of depreciation? **2**

b) Calculate the value of the server after a further five years. **2**

19 The variable l varies inversely with w and when $l = 2$, $w = 5$.
Write down an equation relating l and w. **3**

20 During a live broadcast of a dance competition, 25 000 viewers each gave a dance group a score out of 50 for their performance.

The scores were normally distributed with a mean of 37 and a standard deviation of 4. How many viewers gave them a score greater than 45? **2**

21 The table shows the present values of an annuity of $1 for periods between 58 and 62 months, for different interest rates.

Months	Interest Rate Per Month				
	0.4%	0.5%	0.6%	0.7%	0.8%
58	51.67171	50.23911	48.86109	47.53525	46.25932
59	52.46186	50.98419	49.56370	48.19786	46.88425
60	53.24887	51.72556	50.26213	48.85587	47.50421
61	54.03274	52.46324	50.95639	49.50931	48.11926
62	54.81348	53.19726	51.64651	50.15820	48.72942

Use the table to calculate the monthly repayment needed on a loan of $45 000 at 6% per annum to be repaid over 5 years. **2**

22 Consider the formula $G = \dfrac{PD}{V_1 + V_2}$.

a) Find the value of G when $P = 10,\ D = 1.5,\ V_1 = 3$ and $V_2 = 2$. **2**

b) Rearrange the formula to make P to the subject of the formula and hence evaluate P when $G = 21,\ D = 7,\ V_1 = 12.5$ and $V_2 = 7.5$. **3**

23 In NSW, stamp duty is payable on all vehicles purchased at a rate of \$3 per \$100 or part thereof the vehicle's purchase price.
Calculate the stamp duty payable on a car purchased for \$49 920. **2**

24 The adult dose of a medicine is 600 mg. Use Fried's formula below to calculate the age of a child, in years and months, if the recommended dose is half of that of an adult dose.

Fried's formula for calculating a child dose of medication:

$$Dosage = \frac{age\,(in\ months) \times adult\ dosage}{150}$$

2

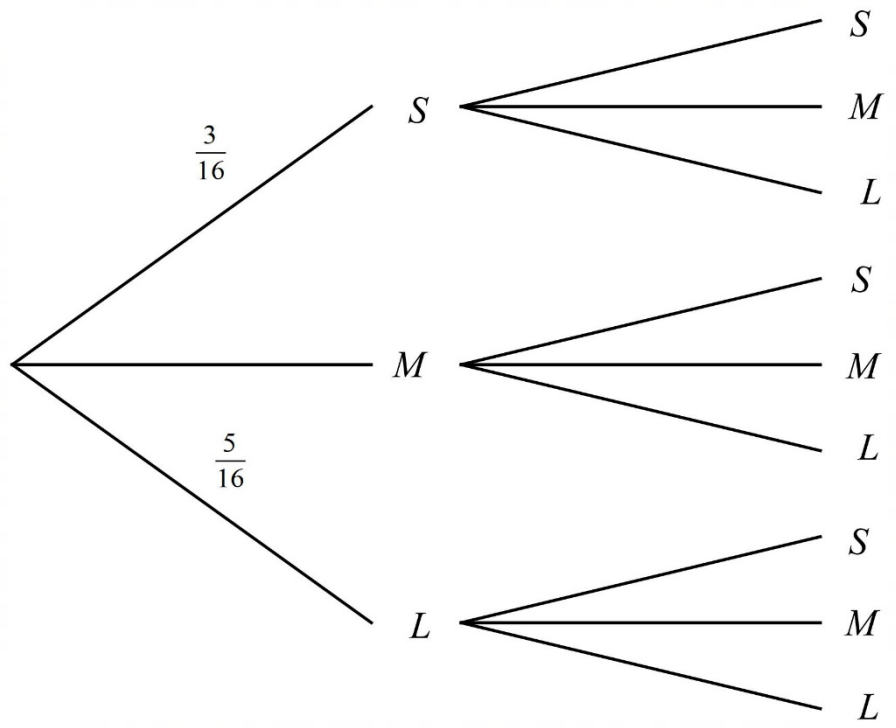
25 Solve $\frac{2x-1}{3}+1=2(x-5)$.

2

26 In a laundry basket there are shirts in three sizes, 3 small, 5 large and 8 medium.

Mike takes two shirts from the basket at random.

The tree diagram below has been started to show the probabilities of different combinations.



By first completing the tree diagram above, calculate the probability that Mike has selected two shirts which are the same size. **3**

27 Sydney has coordinates $(35°S, 150°E)$ and New York has coordinates $(40°N, 80°W)$.

a) Ignoring time zones, what is the time difference, in hours and minutes, between Sydney and New York? **2**

b) An opening ceremony began in Sydney at 7pm on a Friday evening. If this ceremony was shown live on television in New York, at what time and on which day would the broadcast begin? **2**

28 Jonathan works for 5 hours on Mondays and Wednesdays as well as 7 hours on Saturdays. He is paid $15 per hour on weekdays and time-and-a-half for hours worked on the weekend.
How much is Jonathan paid per week? **2**

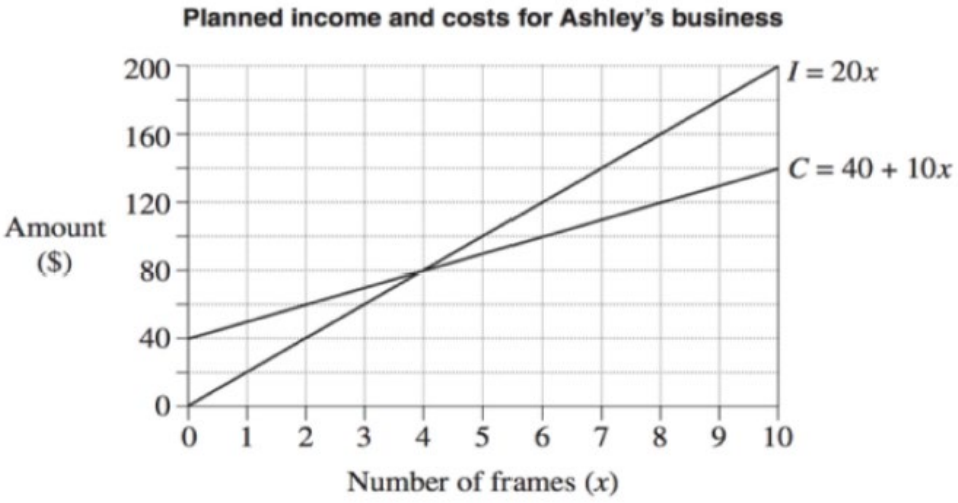
29 In ΔABC, $\angle A = 25°$, $BC = 9$ cm and $AB = 20$ cm.
Find the two possible values for $\angle C$, correct to the nearest degree. **3**

30 Ashley sells framed photos as part of her business. To calculate her cost, C, in dollars, of making x frames, she uses the equation $C = 40 + 10x$.

a) Explain the practical meaning of the gradient and vertical intercept for Ashley's business. **2**

b) Ashley sells her frames for \$20 each and determines her income using the equation $I = 20x$.

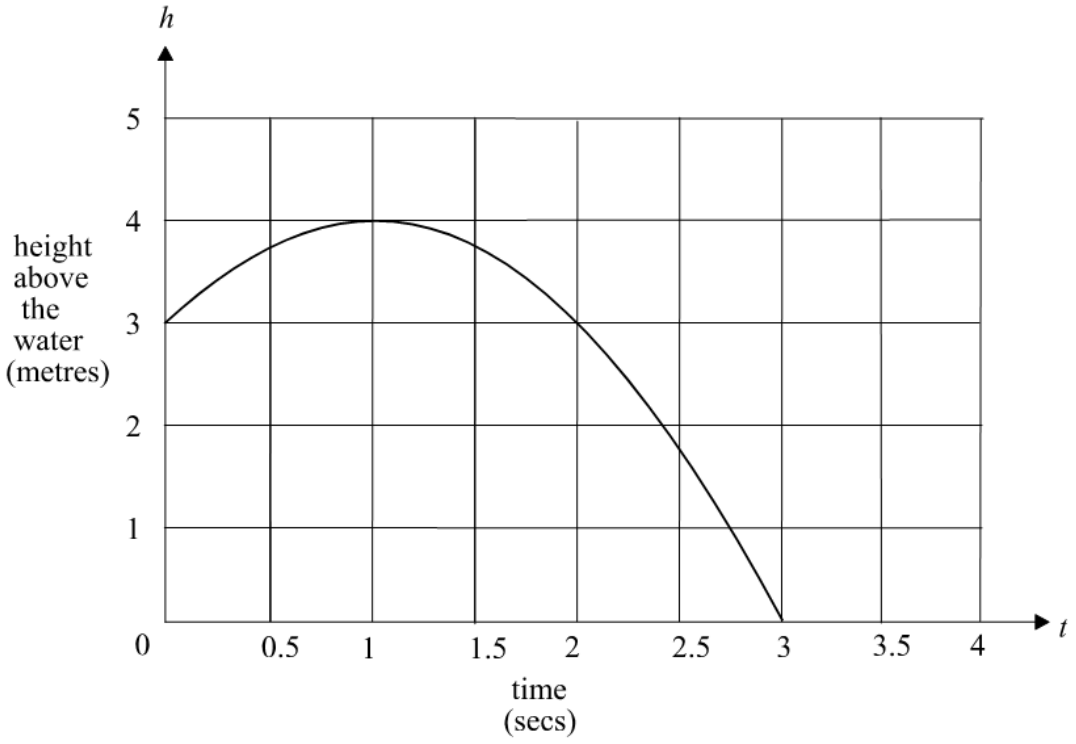
The cost and the income equations are graphed below.



Determine the break-even point given the two equations and explain the implications for Ashley's business. **2**

c) Determine the profit Ashley gains by selling 10 frames. **1**

31 A boy leaps into a lake from the end of a diving board that is attached to a jetty. His height, h, in metres above the water and the time t, taken in seconds, for the leap are shown on the graph below.



a) How far above the water was the boy two seconds after he leaped? **1**

b) When did the boy reach his maximum height above the water? **1**

The graph can be modelled by the equation $h = -t^2 + 2t + c$.

c) Find the value of c. **1**

d) Explain why the model is not appropriate for finding the boy's height above the water at $t = 5$ seconds. **1**

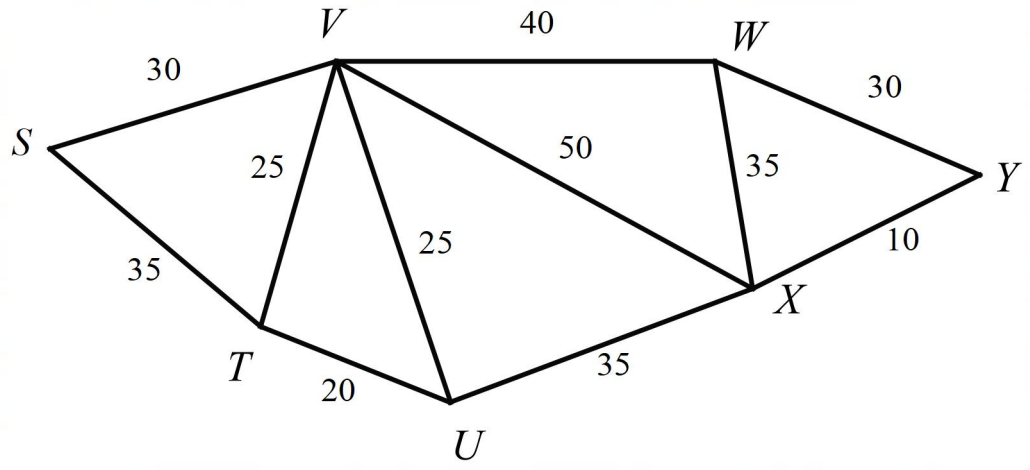
32 A large number of women each have their mass recorded as part of a survey.

If 78 kg corresponds to a z–score of 1.5, and the mean of the distribution is 60 kg, find the standard deviation. **2**

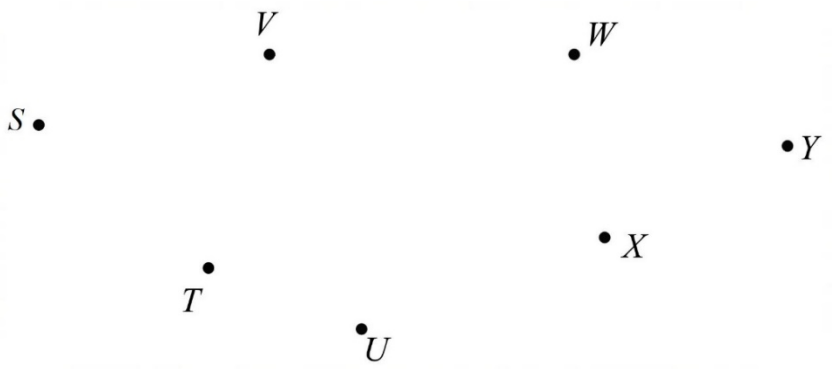
33 A new electricity supply network is to be constructed for seven sites on an estate.

The owners have considered possible routes for the cables connecting the buildings.

The construction cost *in hundreds of dollars* is shown on each cable.

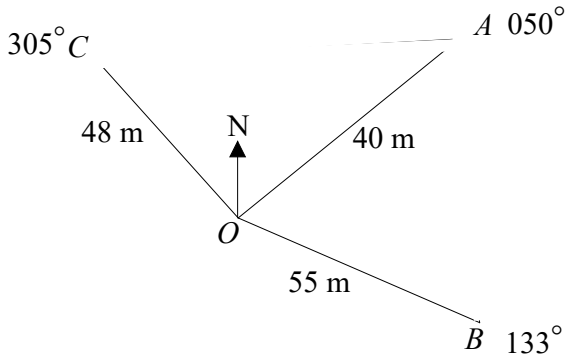


a) Draw a minimum spanning tree for the electricity network on the vertices below. **2**



b) Calculate the minimum cost for supplying electricity to each of the sites. **1**

34 Consider the radial survey below.



Calculate the area of triangle AOB. Answer correct to the nearest square metre. **3**

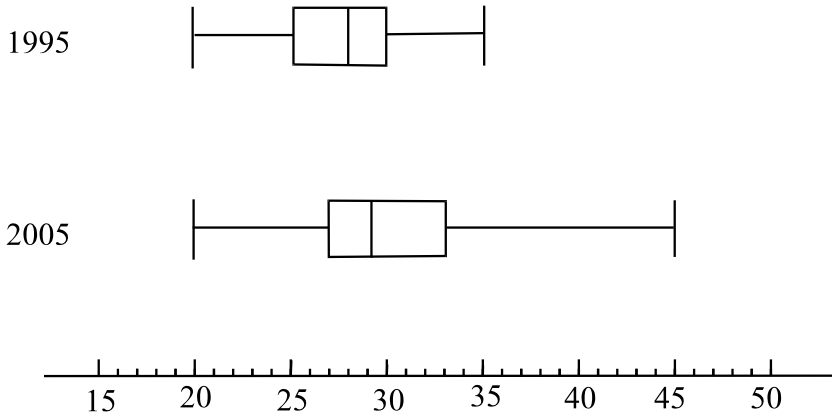
35 The table shows a student's score on a game console and their pulse rate.

Game console (x)	5	7	18	20	30	43	50	58	60	65
Pulse rate (y)	97	93	85	77	75	64	70	64	60	55

a) Calculate the value of the correlation coefficient. Answer correct to 2 decimal places. **1**

b) Use your calculator to determine the value of the gradient, y-intercept and therefore to find the equation of the least squares regression line. **2**

36 The weights of a random sample of 30 Year 2 children were recorded at a particular primary school in 1995. Ten years later the weights of another random sample of 30 Year 2 children at the same school were recorded. The data for the two samples is displayed in the box-and-whisker plots below.



Weight of students in kg.

a) What was the median weight of the sample taken in 1995? **1**

b) What was the interquartile range of the sample taken in 2005? **1**

c) What percentage of children in the sample taken in 1995 weighed less than 25 kg? **1**

d) Compare and contrast the data for 1995 and 2005 by observing the shape and skewness of the distributions together with the measures of location and spread. **2**

37

On August 12, Cassie bought a new phone for $1940 using her credit card.

Interest is charged daily at a rate of 20.65% pa. There is no interest-free period and interest is charged on the date of purchase and the date of payment.

If Cassie made no other purchases on her credit card, what was the amount Cassie had to pay when she paid her account in full on September 28? **2**

38 Sandy is buying a car with a purchase price of $23 500. She pays a 15% deposit and then 36 monthly repayments of $655.60 to repay the balance to a finance company.

What is the annual rate of simple interest being charged by the finance company? **3**

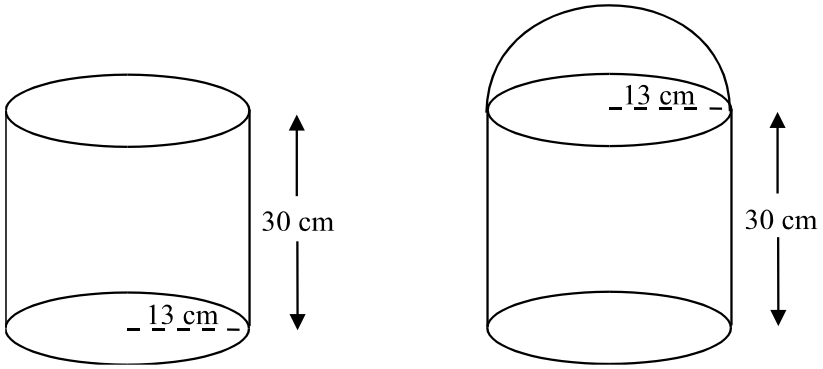
39 Angela sets up this spreadsheet to track the progress of her loan on a monthly basis.

Principal (P) = $45 000.00
Annual Interest rate (r) = 8%
Monthly repayment (R) = $500.00

N	Principal (P)	Interest (I)	*P + I*	*P + I - R*
1	$45,000.00	$300.00	$45,300.00	$44,800.00
2	$44,800.00	$298.67	$45,098.67	$44,598.67
3	$44,598.67	$297.32	$44,895.99	$44,395.99
4	$44,395.99	$295.97	$44,691.96	$44,191.96
5	$44,191.96			Y

Calculate the value that would appear at **Y**. **2**

40 A rubbish bin is in the shape of an open cylinder. It has a radius of 13cm and height 30cm.



Jack has a ball of radius 13cm. He throws it towards the bin and it lands so that it sits on top of the bin as shown above.

a) Calculate the external surface area of the rubbish bin. Express your answer to the nearest square centimetre. **2**

b) Calculate the volume of the solid formed when Jack lands his ball on top of the bin. Express your answer to the nearest cubic centimetre. **2**

41 A dataset is normally distributed with a mean of 75 and a standard deviation of 12.

Using standardised scores and the standard normal distribution table on page 28, find the probability that a randomly chosen score is between 80 and 100. **4**

42 The image below is of a bee.



The real life measurement of the bee from the top of its antennae to its sting (as indicated by the blue dashed line above) is 1.3cm.

a) What scale is used to depict the size of the bee in the image above? Express your answer in the form 1:*n*. **2**

b) What is the actual wingspan, in millimetres, of the bee? **2**

End of Section II
End of Examination

Standard normal distribution: Table values represent the area under the normal curve to the left of the z-score

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55966	.56360	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91308	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899