

2022 HSC Mathematics Standard 2 Marking Guidelines

Section I

Multiple-choice Answer Key

Question	Answer
1	C
2	A
3	B
4	D
5	D
6	B
7	C
8	C
9	A
10	B
11	D
12	B
13	B
14	A
15	C

Section II

Question 16 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides correct answer 	1

Sample answer:

$$\begin{aligned}\text{Maximum heart rate} &= 220 - 25 \\ &= 195\end{aligned}$$

Question 16 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides correct answer 	2
<ul style="list-style-type: none"> Provides a correct percentage 	1

Sample answer:

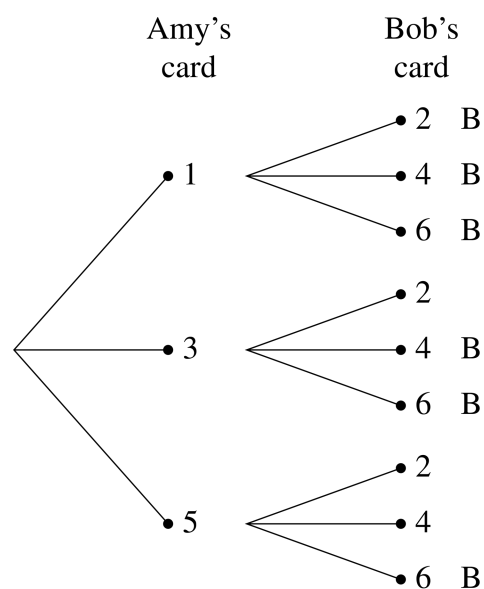
$$50\% \text{ of } 195 = 97.5 \text{ bpm}$$

$$85\% \text{ of } 195 = 165.75 \text{ bpm}$$

Question 17 (a)

Criteria	Marks
• Provides correct solution	2
• Completes the tree diagram, or equivalent merit	1

Sample answer:



Probability Bob wins is $\frac{6}{9} = \frac{2}{3}$

Question 17 (b)

Criteria	Marks
• Provides correct answer	1

Sample answer:

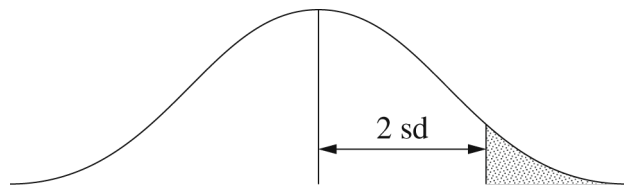
$$\frac{2}{3} \times 30 = 20 \text{ times}$$

Question 18

Criteria	Marks
• Provides correct solution	2
• Finds the z-score, or equivalent merit	1

Sample answer:

$$\mu = 60 \quad \sigma = 15$$



$$z = \frac{90 - 60}{15} = 2$$

$$\% \text{ marks higher: } \frac{1}{2} \times 5\% = 2.5\%$$

2.5% of scores are higher than 90.

Question 19 (a)

Criteria	Marks
• Finds the correct values of A and B	2
• Finds the correct value of A or B	1

Sample answer:

$$A = 98 + 62 = 160$$

$$B = \frac{192}{200} = \frac{96}{100} = 96\%$$

Question 19 (b)

Criteria	Marks
• Provides correct answer	1

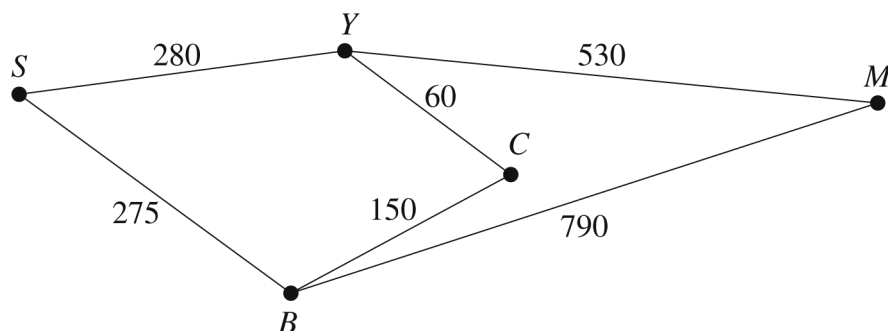
Sample answer:

Stock shortage and delivery fee

Question 20 (a)

Criteria	Marks
• Provides the correct network diagram	2
• Draws a network diagram with vertices shown, or equivalent merit	1

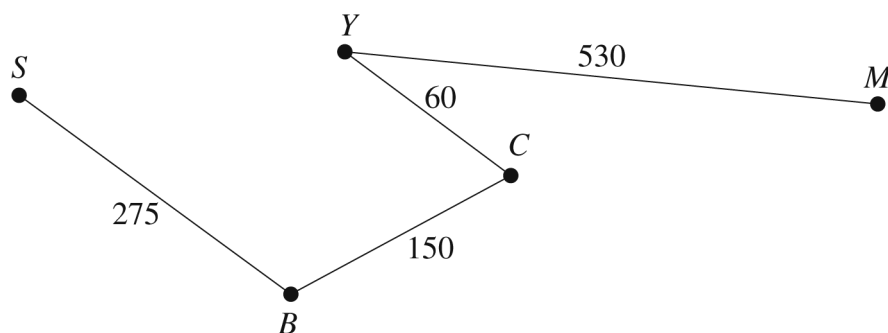
Sample answer:



Question 20 (b)

Criteria	Marks
• Provides correct solution	3
• Draws the minimum spanning tree, or equivalent merit	2
• Draws a spanning tree, or equivalent merit	1

Sample answer:



$$\begin{aligned}
 \text{Length of minimum spanning tree} &= 275 + 150 + 60 + 530 \\
 &= 1015 \text{ km}
 \end{aligned}$$

Question 21

Criteria	Marks
• Provides correct solution	2
• Calculates a correct percentage, or equivalent merit	1

Sample answer:

$$2\% \text{ of } 800\,000 + 1.5\% \text{ of } (1\,500\,000 - 800\,000)$$

$$= 0.02 \times 800\,000 + 0.015 \times 700\,000$$

$$= \$26\,500$$

Question 22 (a)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$C = 100n + b$$

$$C = 100 \times 1943 + 20\,180 = 214\,480$$

$$\text{Cost} = \$214\,480$$

Question 22 (b)

Criteria	Marks
• Provides correct solution	2
• Makes the correct substitution, or equivalent merit	1

Sample answer:

$$a = 26 \quad C = 97\,040 \quad b = 20\,180$$

$$97\,040 = 100n + 26n + 20\,180$$

$$97\,040 = 126n + 20\,180$$

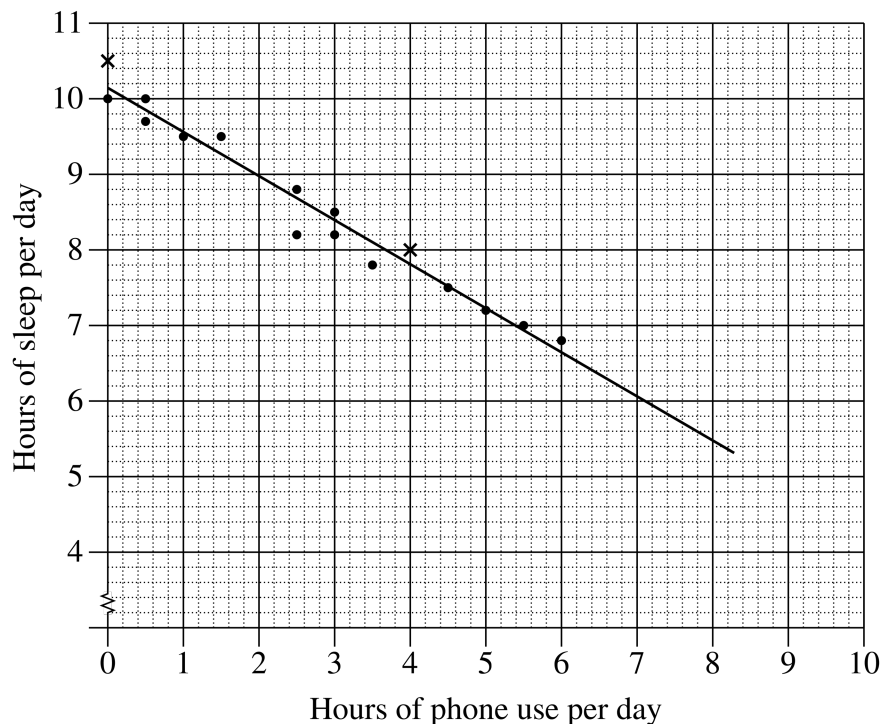
$$76\,860 = 126n$$

$$610 = n$$

Question 23 (a)

Criteria	Marks
• Plots both points correctly	2
• Plots one point correctly, or equivalent merit	1

Sample answer:



Question 23 (b)

Criteria	Marks
• Provides correct solution	2
• Estimates the number of hours of sleep using their line of best fit, or equivalent merit	1

Sample answer:

Line added above.

Student who uses the phone for 2 hours will get 9 hours of sleep per day based on the line of best fit as shown on the scatterplot.

Question 24 (a)

Criteria	Marks
• Provides correct solution	2
• Writes down an equation representing inverse variation, or equivalent merit	1

Sample answer:

$$M = \frac{k}{T}$$

When $T = 15$ $M = 12$

$$12 = \frac{k}{15}$$

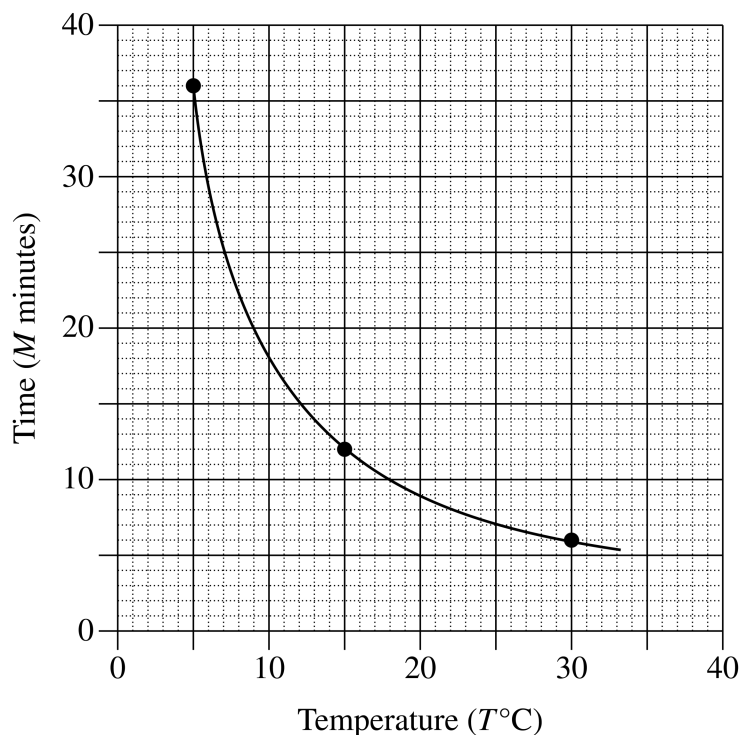
$$k = 15 \times 12 = 180$$

$$M = \frac{180}{T}$$

Question 24 (b)

Criteria	Marks
• Provides correct solution	2
• Completes the table, or equivalent merit	1

Sample answer:



T	5	15	30
M	36	12	6

Question 25 (a)

Criteria	Marks
• Provides correct solution	2
• Finds the correct interest factor, or equivalent merit	1

Sample answer:

$$\$15\,000 \div 4.184 = \$3585.09$$

Question 25 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the total amount deposited, or equivalent merit	1

Sample answer:

$$\text{Amount deposited} = 4 \times \$3585.09 = \$14\,340.36$$

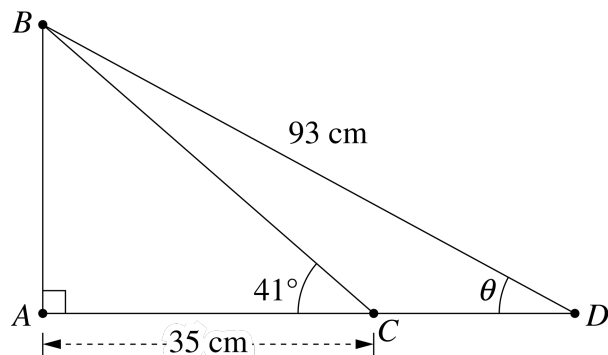
$$\text{Interest} = \$15\,000 - \$14\,340.36 = \$659.64$$

Interest is \$660 (to nearest dollar)

Question 26

Criteria	Marks
• Provides correct solution	4
• Finds the value of $\sin \theta$, or equivalent merit	3
• Finds the length of AB , or equivalent merit	2
• Provides a correct trigonometric ratio related to one of the triangles, or equivalent merit	1

Sample answer:



Using $\triangle ABC$,

$$\tan 41^\circ = \frac{AB}{35}$$

so $AB = 35 \tan 41^\circ$

Using $\triangle ABD$,

$$\sin \theta = \frac{AB}{93}$$

ie $\sin \theta = \frac{35 \tan 41^\circ}{93}$

$$\theta = 19.0959\dots$$

$$\doteq 19^\circ 6' \text{ (to the nearest minute)}$$

Question 27 (a) (i)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$S = V_0 \times (0.80)^n$$

Rate of depreciation is 20%.

Question 27 (a) (ii)

Criteria	Marks
• Provides correct solution	1

Sample answer:

$$\begin{aligned} S &= 50\,000 \times (0.8)^3 \\ &= 25\,600 \end{aligned}$$

Question 27 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the annual depreciated amount, or equivalent merit	1

Sample answer:

$$\begin{aligned} \text{Annual depreciated amount} &= 12.2\% \times 50\,000 \\ &= \$6100 \end{aligned}$$

$$25\,600 = 50\,000 - 6100n$$

$$-24\,400 = -6100n$$

$$\frac{-24\,400}{-6100} = n$$

$$4 = n$$

$$\therefore n = 4 \text{ years}$$

Question 28

Criteria	Marks
• Provides correct solution	4
• Finds the volume of the dam in m^3 , or equivalent merit	3
• Finds the area of the base triangle, or equivalent merit	2
• Attempts to find the area of the base, or equivalent merit	1

Sample answer:

$$\begin{aligned}
 \text{Area of the triangle} &= \frac{1}{2} ab \sin C \\
 &= \frac{1}{2} \times 25 \times 25 \times \sin 150^\circ \\
 &= 156.25 \text{ m}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Volume of dam} &= 156.25 \times 50 \\
 &= 7812.5 \text{ m}^3
 \end{aligned}$$

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

$$\begin{aligned}
 \text{Number of litres} &= 7812.5 \times 1000 \\
 &= 7\,812\,500 \text{ L}
 \end{aligned}$$

Question 29

Criteria	Marks
• Provides correct solution	3
• Finds the time in Sydney when the plane lands in New York, or equivalent merit	2
• Finds the time difference between Sydney and New York, or equivalent merit	1

Sample answer:

$$\text{Time difference} = 10 - -5$$

$$= 15 \text{ hours}$$

8:20 pm on Wednesday (Sydney) plus 20 hours 24 minutes

= 4:44 pm Thursday (Sydney)

4:44 pm – 15 hours = 1:44 am New York

In New York it will be 1:44 am Thursday.

Question 30 (a)

Criteria	Marks
• Provides correct solution	2
• Writes an expression for the future value with some correct element(s), or equivalent merit	1

Sample answer:

$P = 40\,000$, $r = 1.2\%$ pa compounded monthly, $N = 10 \times 12 = 120$

$$FV = 40\,000 \left(1 + \frac{0.012}{12} \right)^{120}$$

$$= \$45\,097.17$$

Question 30 (b)

Criteria	Marks
• Provides correct solution	2
• Calculates the future value using the interest factor table, or equivalent merit	1

Sample answer:

Option 2

10 years quarterly $\Rightarrow N = 10 \times 4 = 40$

$$r = \frac{2.4\%}{4} = \frac{0.024}{4} = 0.006$$

From table: 45.05630

So $FV = 45.05630 \times 1000$

$$= 45\,056.30$$

As Option 1 = \$45 097.17, the difference is \$40.87 .

Question 31 (a)

Criteria	Marks
<ul style="list-style-type: none"> Provides correct answer 	1

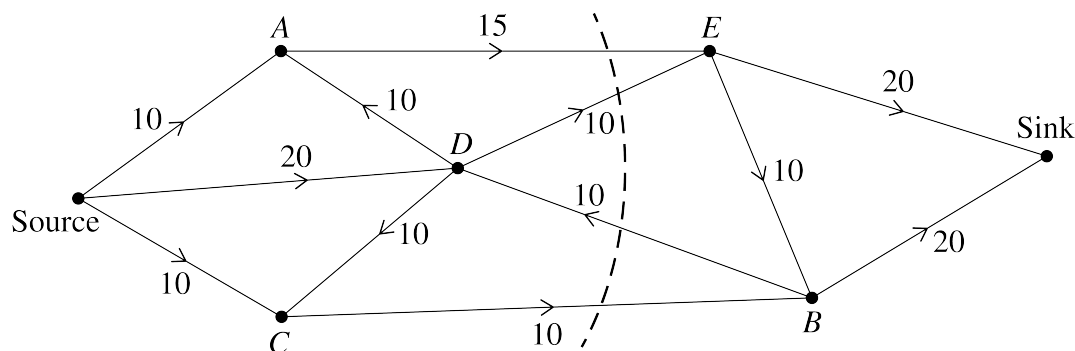
Sample answer:

Capacity of cut is 40.

Question 31 (b)

Criteria	Marks
<ul style="list-style-type: none"> Provides correct solution 	2
<ul style="list-style-type: none"> Shows a cut of less than 40, or equivalent merit 	1

Sample answer:



For the maximum flow capacity to be 40, there must be a minimum cut of 40. Since there is a cut of 35 (see above in diagram) then the maximum flow must be less than 40.

Question 31 (c)

Criteria	Marks
<ul style="list-style-type: none"> Provides correct solution 	2
<ul style="list-style-type: none"> Gives the correct path OR the current amount, or equivalent merit 	1

Sample answer:

The path from *C* to *B* can be increased by 5.

Answers could include:

The path from *A* to *E*, increased by 5

The path from *D* to *E*, increased by 5

Question 32 (a)

Criteria	Marks
• Provides correct solution	2
• Applies the trapezoidal rule, or equivalent merit	1

Sample answer:

$$A = \frac{1}{2} \times 100 \times (160 + 150) + \frac{1}{2} \times 100 \times (150 + 250)$$

$$= 50 \times 310 + 50 \times 400$$

$$\text{Area} = 35\,500 \text{ m}^2$$

Question 32 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the area of the rectangle and semicircle, or equivalent merit	1

Sample answer:

Total area = rectangle + semicircle

$$= 200 \times 250 + \frac{1}{2} \times \pi \times 100^2$$

$$= 65\,707.96$$

$$\approx 65\,708 \text{ m}^2$$

Lake area = total area – grassed section

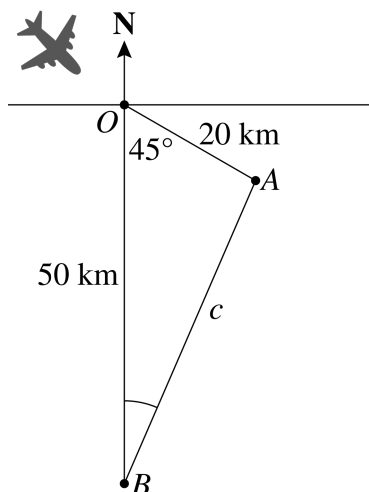
$$= 65\,708 - 35\,500$$

$$= 30\,208 \text{ m}^2$$

Question 33 (a)

Criteria	Marks
• Provides correct solution	2
• Attempts to use the cosine rule, or equivalent merit	1

Sample answer:



Using cosine rule.

$$\begin{aligned}
 c^2 &= a^2 + b^2 - 2ab \cos C \\
 &= 50^2 + 20^2 - 2 \times 20 \times 50 \cos 45^\circ \\
 c^2 &= 1485.78... \\
 c &= 38.5 \text{ (correct to 1 decimal place)}
 \end{aligned}$$

Question 33 (b)

Criteria	Marks
• Provides correct solution	2
• Attempts to use the sine rule	1

Sample answer:

$$\begin{aligned}
 \frac{\sin(\angle OBA)}{20} &= \frac{\sin 45^\circ}{38.5} \\
 \sin(\angle OBA) &= \frac{20 \sin 45^\circ}{38.5} \\
 &= 0.3673... \\
 \angle OBA &= 22^\circ \text{ (nearest degree)}
 \end{aligned}$$

Question 33 (c)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$180^\circ + 22^\circ = 202^\circ$$

Question 34

Criteria	Marks
• Provides correct solution	4
• Calculates the curved area of the cylinder AND of the hemisphere	3
• Calculates the curved area of the cylinder OR of the hemisphere	2
• Calculates any relevant area	1

Sample answer:

Surface area of:

Sphere = $4\pi r^2$ (diameter of 6 cm so radius of 3 cm)

$$\text{Curved bottom of hemisphere} = \frac{1}{2} \times 4\pi \times 3^2$$

$$\begin{aligned} \text{Top of hemisphere} &= \pi \times 3^2 - (\text{bottom of cylinder}) \\ &= \pi \times 3^2 - \pi \times 2^2 \end{aligned}$$

$$\text{Top of cylinder} = \pi \times 2^2$$

$$\text{Curved side of cylinder} = 2\pi \times 2 \times 3$$

$$\begin{aligned} \text{Total surface area} &= \frac{1}{2} \times 4\pi \times 3^2 + \pi \times 3^2 - \pi \times 2^2 + \pi \times 2^2 + 2\pi \times 6 \\ &= 122.5 \text{ cm}^2 \end{aligned}$$

Question 35

Criteria	Marks
<ul style="list-style-type: none"> Provides a comprehensive description and interpretation of the data and other information, in the given context 	4
<ul style="list-style-type: none"> Provides a sound description and interpretation of the data and other information, in the given context 	3
<ul style="list-style-type: none"> Provides some description and interpretation of the data and/or other information 	2
<ul style="list-style-type: none"> Provides some relevant information 	1

Answers could include:

The data show that:

- The relationship is linear and positive/increasing. The correlation of 0.4564 is weak/moderate.
- As character age increases by 1 year, the actor age increases by almost 2 years.
- The actors playing teenagers do not need to be teenagers themselves. The ages of characters range from 14 to 17 but the ages of actors playing these characters range from 14 to 30. This means that there is no need for just young actors but older people can play teenage characters.
- There are only a few characters of age 14 and they are played by actors ranging in age between 14–23.
- Characters of age 15 is the largest group and they are played by actors with the widest age range (14–27).
- Characters older than 15 are all played by older actors. The youngest actors in the dataset are playing characters close to their own age.

Question 36 (a)

Criteria	Marks
• Provides correct solution	2
• Calculates either A or B	1

Sample answer:

$r = 7.2\%$ pa monthly

$$\begin{aligned} A &= 199\,715 \times 0.006 \\ &= \$1198.29 \end{aligned}$$

$$\begin{aligned} B &= 199\,428.29 + 1196.57 - 1485 \\ &= \$199\,139.86 \end{aligned}$$

Question 36 (b)

Criteria	Marks
• Provides correct solution	3
• Calculates the total amount repaid	2
• Calculates the total repayments under the original arrangements OR finds the total number of repayments made	1

Sample answer:

$$\begin{aligned} \text{Number of repayments} &= 50 + 146 \\ &= 196 \end{aligned}$$

$$\begin{aligned} \text{Total amount repaid} &= 196 \times \$1485 + \$40\,000 \\ &= \$331\,060 \end{aligned}$$

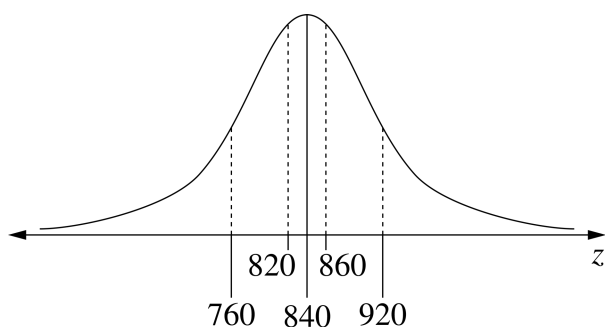
$$\begin{aligned} \text{Repayment under original conditions} &= 23 \times 12 \times \$1485 \\ &= \$409\,860 \end{aligned}$$

$$\begin{aligned} \text{Frankie saves} &= \$409\,860 - \$331\,060 \\ &= \$78\,800 \end{aligned}$$

Question 37

Criteria	Marks
• Provides correct solution	3
• Recognises that 34% have a life span between 840 and 920 AND attempts to use the information given regarding the statistical tables	2
• Recognises that 68% have a life span between 760 and 920, or equivalent merit	1

Sample answer:



60% have a life span < 860 .

\therefore 10% have a life span between 840 and 860.

\therefore 10% have a life span between 820 and 840.

68% have a life span between 760 and 920.

\therefore 34% have a life span between 840 and 920.

\therefore percentage with life span between 820 and 920 hours is $10\% + 34\% = 44\%$.

Question 38

Criteria	Marks
• Provides correct solution	3
• Calculates the amount of cordial and of water in the mixture of 3.6 L	2
• Attempts to apply the ratio 1 : 3 to the mixture of 3.6 L	1

Sample answer:

4.8 L cordial to water 1 : 3

Remove 1.2 L

3.6 L in ratio 1 : 3

$$\frac{3.6}{4} \text{ L of cordial} = 0.9 \text{ L cordial}$$

$$\frac{3.6 \times 3}{4} \text{ L of water} = 2.7 \text{ L water}$$

Add 1.2 L of water

$$\begin{aligned} \text{New ratio} &= 0.9 \text{ L cordial} : 3.9 \text{ L water} \\ &= 3 \text{ cordial} : 13 \text{ water} \end{aligned}$$

3 : 13 cordial to water.

2022 HSC Mathematics Standard 2 Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	MS-S1 Data Analysis	MS11-2
2	1	MS-A2 Linear Relationships	MS11-2
3	1	MS-N3 Critical Path Analysis	MS2-12-8
4	1	MS-M7 Rates and Ratios	MS2-12-3
5	1	MS-S1 Data Analysis	MS11-7
6	1	MS-M7 Rates and Ratios	MS2-12-3
7	1	MS-F1 Money Matters	MS11-10
8	1	MS-M6 Non-right-angled Trigonometry	MS2-12-4
9	1	MS-A4 Types of Relationships	MS2-12-6
10	1	MS-F4 Investments and Loans	MS2-12-5
11	1	MS-F4 Investments and Loans	MS2-12-5
12	1	MS-S4 Bivariate Data Analysis	MS2-12-2
13	1	MS-S5 The Normal Distribution	MS2-12-7
14	1	MS-A1 Formulae and Equations	MS11-1
15	1	MS-S1 Data Analysis	MS11-2

Section II

Question	Marks	Content	Syllabus outcomes
16 (a)	1	MS-M7 Rates and Ratios	MS2-12-3
16 (b)	2	MS-M7 Rates and Ratios	MS2-12-3
17 (a)	2	MS-S2 Relative Frequency and Probability	MS11-8
17 (b)	1	MS-S2 Relative Frequency and Probability	MS11-8
18	2	MS-S5 The Normal Distribution	MS2-12-7
19 (a)	2	MS-S1 Data Analysis	MS11-2
19 (b)	1	MS-S1 Data Analysis	MS11-2
20 (a)	2	MS-N2 Network Concepts	MS2-12-8
20 (b)	3	MS-N2 Network Concepts	MS2-12-8
21	2	MS-F1 Money Matters	MS11-5
22 (a)	1	MS-A2 Linear Relationships	MS11-6

Question	Marks	Content	Syllabus outcomes
22 (b)	2	MS-A2 Linear Relationships	MS11-6
23 (a)	2	MS-S4 Bivariate Data Analysis	MS2-12-2
23 (b)	2	MS-S4 Bivariate Data Analysis	MS2-12-10
24 (a)	2	MS-A4 Types of Relationships	MS2-12-6
24 (b)	2	MS-A4 Types of Relationships	MS2-12-6
25 (a)	2	MS-F5 Annuities	MS2-12-5
25 (b)	2	MS-F5 Annuities	MS2-12-5
26	4	MS-M6 Non-right-angled Trigonometry	MS2-12-4
27 (a) (i)	1	MS-F4 Investments and Loans	MS2-12-5
27 (a) (ii)	1	MS-F4 Investments and Loans	MS2-12-5
27 (b)	2	MS-F4 Investments and Loans	MS2-12-5
28	4	MS-M6 Non-right-angled Trigonometry	MS2-12-4
29	3	MS-M2 Working with Time	MS11-10
30 (a)	2	MS-F4 Investments and Loans	MS2-12-10
30 (b)	2	MS-F5 Annuities	MS2-12-10
31 (a)	1	MS-N3 Critical Path Analysis	MS2-12-8
31 (b)	2	MS-N3 Critical Path Analysis	MS2-12-8
31 (c)	2	MS-N3 Critical Path Analysis	MS2-12-8
32 (a)	2	MS-M7 Rates and Ratios	MS2-12-4
32 (b)	2	MS-M7 Rates and Ratios	MS2-12-4
33 (a)	2	MS-M6 Non-right-angled Trigonometry	MS2-12-4
33 (b)	2	MS-M6 Non-right-angled Trigonometry	MS2-12-4
33 (c)	1	MS-M6 Non-right-angled Trigonometry	MS2-12-4
34	4	MS-M1 Applications of Measurement	MS2-11-4
35	4	MS-S4 Bivariate Data Analysis	MS2-12-10
36 (a)	2	MS-F5 Annuities	MS2-12-5
36 (b)	3	MS-F5 Annuities	MS2-12-10
37	3	MS-S5 The Normal Distribution	MS2-12-7
38	3	MS-M7 Rates and Ratios	MS2-12-3