

2019 HSC Mathematics Standard 2 Marking Guidelines

Section I

Multiple-choice Answer Key

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

Section II

Question 16

| Criteria | Marks |
|---|-------|
| • Provides correct solution | 2 |
| • Applies the volume of a sphere formula, or equivalent merit | 1 |

Sample answer:

The radius of the bowl is 8 cm.

$$\begin{aligned}
 \text{Volume} &= \frac{1}{2} \times \frac{4}{3} \pi r^3 \\
 &= \frac{1}{2} \times \frac{4}{3} \pi (8)^3 \\
 &= 1072 \text{ cm}^3 \quad (\text{nearest cubic centimetre})
 \end{aligned}$$

Question 17

| Criteria | Marks |
|---|-------|
| • Provides correct solution with correct rounding | 3 |
| • Calculates correct value of x | 2 |
| • Attempts to use cosine rule | 1 |

Sample answer:

$$\begin{aligned}
 x^2 &= 11^2 + 13^2 - 2 \times 11 \times 13 \times \cos 80^\circ \\
 &= 240.3306... \\
 \therefore x &= \sqrt{240.366...} \\
 &= 15.5027... \\
 &= 16 \quad (2 \text{ significant figures})
 \end{aligned}$$

Question 18 (a)

| Criteria | Marks |
|---------------------------------------|-------|
| • Provides correct answer | 2 |
| • Provides correct unsimplified ratio | 1 |

Sample answer:

$$\begin{aligned}\text{Ratio} &= 30 : 25 : 40 \\ &= 6 : 5 : 8 \quad (\text{in simplest form})\end{aligned}$$

Question 18 (b)

| Criteria | Marks |
|--|-------|
| • Provides correct answer | 2 |
| • Calculates the total runs for Andrew, Brandon and Cosmo, or equivalent merit | 1 |

Sample answer:

The total number of runs scored by Andrew, Brandon and Cosmo is $30 + 25 + 40 = 95$.

Let x be the number of runs scored by the whole team

$$19 : 36 = 95 : x$$

$$\frac{x}{95} = \frac{36}{19}$$

$$x = \frac{36}{19} \times 95$$

$$\therefore x = 180 \text{ runs}$$

Question 19

| Criteria | Marks |
|---|-------|
| • Provides correct solution with justification | 3 |
| • Calculates the interquartile range, or equivalent merit | 2 |
| • Finds a quartile, or equivalent merit | 1 |

Sample answer:

$$Q_1 = 185 \text{ and } Q_3 = 194$$

$$\begin{aligned}IQR &= 194 - 185 \\ &= 9\end{aligned}$$

An outlier is less than $Q_1 - 1.5 IQR$

$$\begin{aligned}&= 185 - 1.5 \times 9 \\ &= 171.5\end{aligned}$$

Since $170 < 171.5$, the smallest height is considered an outlier.

Question 20

| Criteria | Marks |
|---|-------|
| • Provides correct answer or correct numerical expression | 2 |
| • Multiplies an incorrect probability by 18 500 | 1 |

Sample answer:

$$\begin{aligned}\text{Expected number} &= 18\,500 \times \frac{1}{37} \\ &= 500\end{aligned}$$

Question 21

| Criteria | Marks |
|---|-------|
| • Provides correct solution | 2 |
| • Calculates total value of the shares, or equivalent merit | 1 |

Sample answer:

$$\begin{aligned}\text{Dividend yield} &= \frac{1068.20}{1526 \times 8.75} \\ &= 0.08 \\ &= 8\%\end{aligned}$$

Question 22

| Criteria | Marks |
|--|-------|
| • Provides correct solution | 3 |
| • Uses a trigonometric ratio with the correct value of AC, or equivalent merit | 2 |
| • Calculates AC, or equivalent merit | 1 |

Sample answer:

$$\begin{aligned}AC^2 &= 2.5^2 + 6^2 \\ &= 42.25\end{aligned}$$

$$\therefore AC = 6.5$$

$$\cos \theta = \frac{4.9}{6.5}$$

$$\therefore \theta = 41.075\dots^\circ$$

$$= 41^\circ 5' \text{ (nearest minute)}$$

Question 23 (a)

| Criteria | Marks |
|--|-------|
| • Provides correct answer with or without correct rounding | 1 |

Sample answer:

$0.9811199... \approx 0.98$ (2 decimal places)

Question 23 (b)

| Criteria | Marks |
|---|-------|
| • Provides correct direction and strength | 1 |

Sample answer:

Positive, strong

Question 23 (c)

| Criteria | Marks |
|---------------------------|-------|
| • Provides correct answer | 1 |

Sample answer:

$0.866 \times 143 + 23.7 = 147.538$ cm

Question 24

| Criteria | Marks |
|--|-------|
| • Provides correct solution | 2 |
| • Provides one correct conversion of energy, or equivalent merit | 1 |

Sample answer:

$$2180 \text{ kilojoules} = \frac{2180}{4.184} = 521.03 \text{ kilocalories}$$

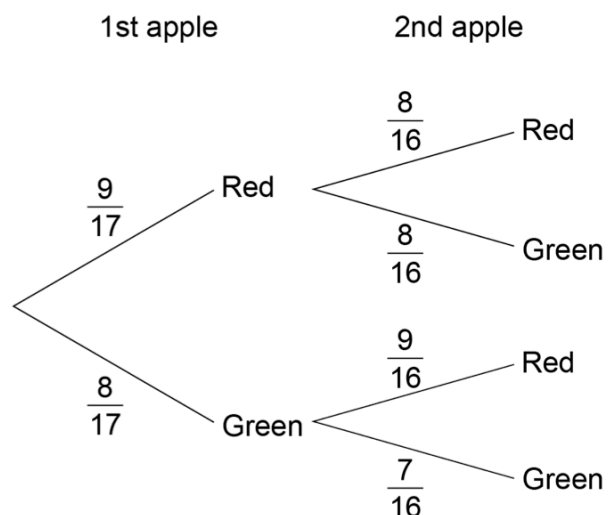
$$\text{Amanda needs to run } \frac{521.03}{80} = 6.5129...$$

$$= 6.5 \text{ km (one decimal place)}$$

Question 25

| Criteria | Marks |
|--|-------|
| • Provides correct solution | 3 |
| • Provides correct probability tree diagram, or equivalent merit | 2 |
| • Draws a relevant tree diagram, or equivalent merit | 1 |

Sample answer:



$$P(\text{same colour}) = P(RR) + P(GG)$$

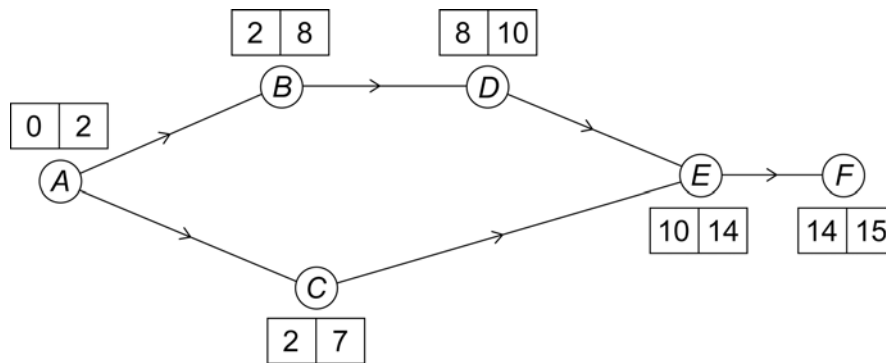
$$= \frac{9}{17} \times \frac{8}{16} + \frac{8}{17} \times \frac{7}{16}$$

$$= \frac{8}{17}$$

Question 26 (a)

| Criteria | Marks |
|---|-------|
| • Provides a correct network diagram and correct minimum time | 3 |
| • Provides a correct network diagram or correct minimum time from incorrect network diagram | 2 |
| • Connects three vertices correctly or equivalent merit | 1 |

Sample answer:



Minimum time = 15 hours

Question 26 (b)

| Criteria | Marks |
|---------------------------|-------|
| • Provides correct answer | 1 |

Sample answer:

The float time for the non-critical activity (C) is 3 hours.

Question 27

| Criteria | Marks |
|--|-------|
| • Provides correct solution | 3 |
| • Correctly uses compound interest, or equivalent merit | 2 |
| • Calculates the correct number of days, or equivalent merit | 1 |

Sample answer:

$$\begin{aligned} \text{Closing balance} &= 3700 \times \left(1 + \frac{0.1825}{365}\right)^{11} \\ &= \$3720.40 \end{aligned}$$

$$\begin{aligned} \text{Minimum payment due} &= 0.02 \times 3720.40 \\ &= \$74.41 \end{aligned}$$

Question 28

| Criteria | Marks |
|---|-------|
| • Provides correct answer with appropriate calculations | 4 |
| • Calculates the correct length of time for <i>BAC</i> to reach zero, or equivalent merit | 3 |
| • Calculates the correct <i>BAC</i> , or correct numerical expression | 2 |
| • Provides correct value for <i>N</i> or <i>H</i> , or equivalent merit | 1 |

Sample answer:

$$H = 6 \text{ h } 15 \text{ min}$$

$$= 6.25$$

$$N = (3 \times 1.2) + (4 \times 1)$$

$$= 7.6$$

$$\therefore BAC = \frac{(10 \times 7.6) - (7.5 \times 6.25)}{5.5 \times 60}$$

$$= 0.088257...$$

$$\therefore \text{Time to zero } BAC = \frac{0.088257...}{0.015}$$

$$= 5 \text{ h } 53 \text{ min (to nearest minute)}$$

$$\therefore \text{Time to get to zero } BAC = 12:30 \text{ am} + 5 \text{ hours } 53 \text{ min}$$

$$= 6:23 \text{ am}$$

Question 29

| Criteria | Marks |
|--|-------|
| • Provides both correct answers or correct numerical expressions | 2 |
| • Provides correct value for <i>A</i> or uses incorrect value for <i>A</i> to calculate value for <i>B</i> | 1 |

Sample answer:

$$\text{Price of chocolates} = 0.70 \times 11$$

$$= \$7.70$$

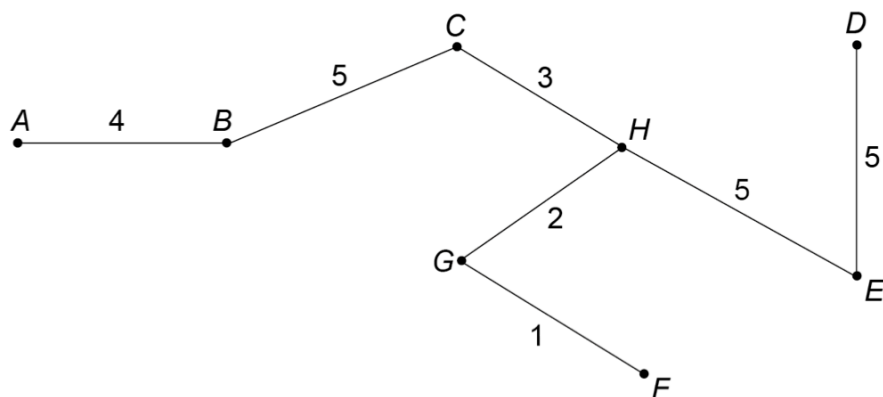
$$\text{Price of natural almonds} = 36.25 - (7.70 + 5.00 + 8.50 + 3.20 + 2.85)$$

$$= \$9.00$$

Question 30 (a)

| Criteria | Marks |
|--|-------|
| • Provides a correct minimum spanning tree and correct minimum length | 2 |
| • Calculates the minimum length from an incorrect network diagram, or equivalent merit | 1 |

Sample answer:



[Other minimum spanning trees are possible]

The minimum length of water pipes needed is 25 kilometres.

Question 30 (b)

| Criteria | Marks |
|---------------------------|-------|
| • Provides correct answer | 1 |

Sample answer:

Path goes from *C* to *G* to *H* to *E*.

Question 31 (a)

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

Sample answer:

The width of the rectangle must be a positive number.

Question 31 (b)

| Criteria | Marks |
|---|-------|
| <ul style="list-style-type: none"> Provides correct answer | 2 |
| <ul style="list-style-type: none"> Provides correct width, or equivalent merit | 1 |

Sample answer:

From the graph, if $A = 18$ we have $w = 2$.

If the width of the rectangle is 2 cm the length must be 9 cm.

$$\begin{aligned}\text{Perimeter} &= 2 \times 2 + 2 \times 9 \\ &= 22 \text{ cm}\end{aligned}$$

Question 32

| Criteria | Marks |
|--|-------|
| <ul style="list-style-type: none"> Provides correct solution | 3 |
| <ul style="list-style-type: none"> Attempts to use the correct tax bracket with the correct taxable income, or equivalent merit | 2 |
| <ul style="list-style-type: none"> Attempts to use the correct tax bracket for an incorrect taxable income, or equivalent merit | 1 |

Sample answer:

$$\text{Taxable income} = \frac{1934.80}{0.02}$$

$$= \$96\,740$$

$$\text{Tax payable} = 20\,797 + 0.37 \times (96\,740 - 90\,000)$$

$$= \$23\,290.80$$

Question 33 (a)

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

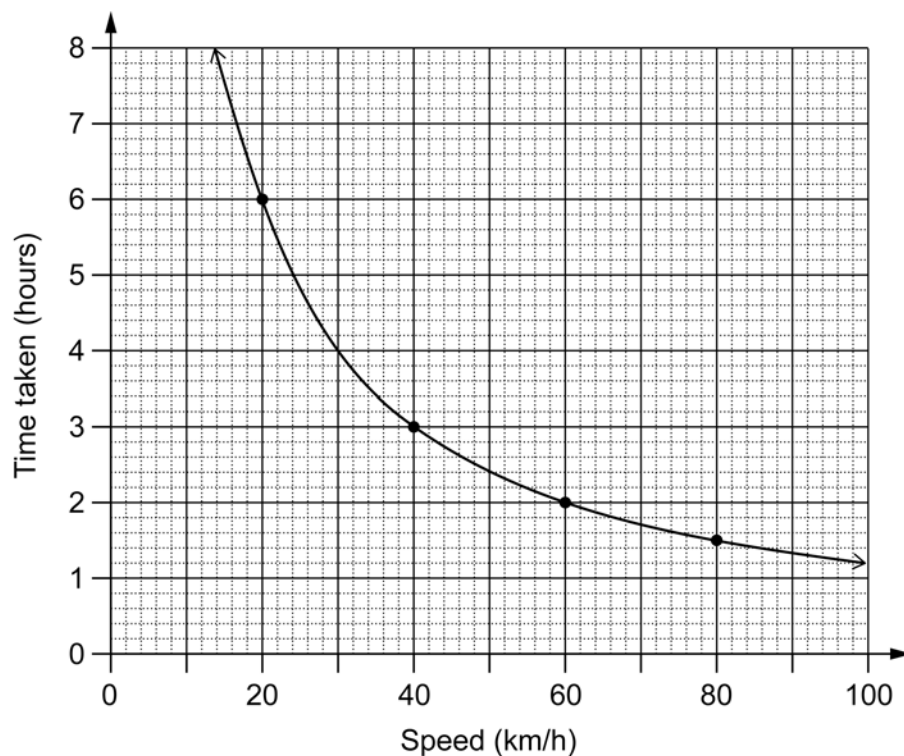
Sample answer:

$$\begin{aligned}
 D &= S \times T \\
 &= 80 \times 1.5 \\
 &= 120 \text{ km}
 \end{aligned}$$

Question 33 (b)

| Criteria | Marks |
|---|-------|
| <ul style="list-style-type: none"> Draws correct curve | 3 |
| <ul style="list-style-type: none"> Plots three correct points, or equivalent merit | 2 |
| <ul style="list-style-type: none"> Plots one correct point | 1 |

Sample answer:



Question 34 (a)

| Criteria | Marks |
|---------------------------|-------|
| • Provides correct answer | 1 |

Sample answer:

$$p = \frac{4}{7}d$$

Question 34 (b)

| Criteria | Marks |
|---|-------|
| • Provides correct answer or correct numerical expression | 2 |
| • Provides one correct currency conversion | 1 |

Sample answer:

$$\begin{aligned} 93\,100 \text{ Japanese yen} &= \frac{93\,100}{76} \\ &= 1225 \text{ Australian dollars} \end{aligned}$$

$$p = \frac{1225 \times 4}{7} = 700$$

$\therefore 93\,100 \text{ Japanese yen} = 700 \text{ British pounds}$

Question 35

| Criteria | Marks |
|--|-------|
| • Provides correct solution | 3 |
| • Correctly calculates angle BOC | 2 |
| • Attempts to use the area of a triangle formula $A = 0.5ab\sin C$ | 1 |

Sample answer:

$$198 = \frac{1}{2} \times 16 \times 25 \times \sin(\angle COB)$$

$$198 = 200 \sin(\angle COB)$$

$$\sin(\angle COB) = \frac{198}{200}$$

$$= 81.9^\circ$$

$\therefore \text{Bearing of } C \text{ from } O \text{ is } 125 + 81.9 = 207^\circ \text{ (nearest degree)}$

Question 36 (a)

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

Sample answer:

20 bird houses

Question 36 (b)

| Criteria | Marks |
|--|-------|
| <ul style="list-style-type: none"> Provides correct solution | 3 |
| <ul style="list-style-type: none"> Provides correct formulae for R and C, or equivalent merit | 2 |
| <ul style="list-style-type: none"> Provides correct formula for R or C, or equivalent merit | 1 |

Sample answer:

$$R = 40x$$

$$C = 500 + 15x$$

$$\therefore 1900 = 40x - (500 + 15x)$$

$$1900 = 25x - 500$$

$$2400 = 25x$$

$$x = \frac{2400}{25}$$

$$= 96$$

\therefore 96 bird houses must be sold to earn a profit of \$1900.

Question 37

| Criteria | Marks |
|---|-------|
| • Provides correct answer or correct numerical expression | 3 |
| • Calculates the correct depreciation percentage, or equivalent merit | 2 |
| • Attempts to use the declining-balance formula, or equivalent merit | 1 |

Sample answer:

Let r be the rate of depreciation per annum.

$$21\,457 = 24\,950 \times (1 - r)^1$$

$$0.86 = 1 - r$$

$$\therefore r = 0.14$$

$$\begin{aligned} \text{After ten years, value} &= 24\,950 \times (1 - 0.14)^{10} \\ &= \$5\,521.47 \end{aligned}$$

Question 38

| Criteria | Marks |
|---|-------|
| • Provides correct answer | 2 |
| • Uses z-score formula with incorrect standard deviation, or equivalent merit | 1 |

Sample answer:

$$\text{Standard deviation} = \frac{4400 - 3000}{2}$$

$$= 700 \text{ g}$$

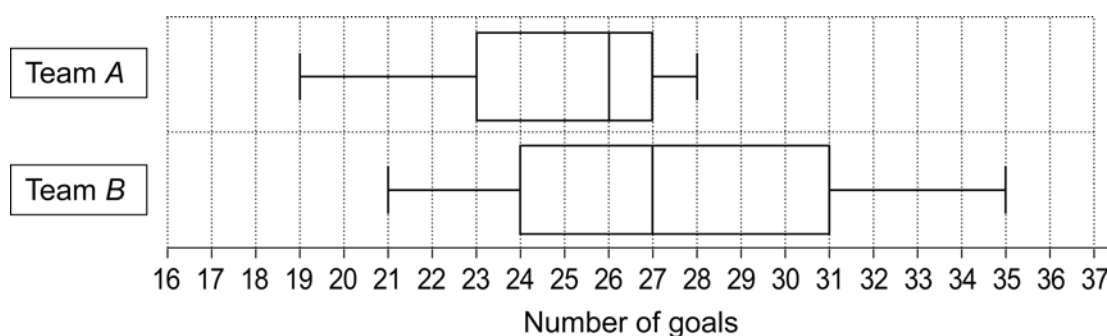
$$\therefore \text{z-score} = \frac{3497 - 3000}{700}$$

$$= 0.71$$

Question 39

| Criteria | Marks |
|--|-------|
| • Provides correct box-plot AND comparisons of 'central tendency, spread and skewness' | 5 |
| • Provides correct box-plot AND compares two of 'central tendency, spread and skewness', or equivalent merit | 4 |
| • Provides correct box-plot AND compares one of 'central tendency, spread and skewness', or equivalent merit | 3 |
| • Provides correct box-plot OR compares two of 'central tendency, spread and skewness' or equivalent merit | 2 |
| • Provides one correct quartile for team A or correct comparison of the minimum or maximum scores, or equivalent merit | 1 |

Sample answer:



Team A is more consistent because the *IQR* is smaller, as shown by the shorter box. Team B generally scores more goals per game as shown by a higher median (27 compared to 26). Team A is skewed negatively compared to Team B which is slightly positively skewed. Half of Team B's scores are higher than 75% of Team A's scores.

Question 40 (a)

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

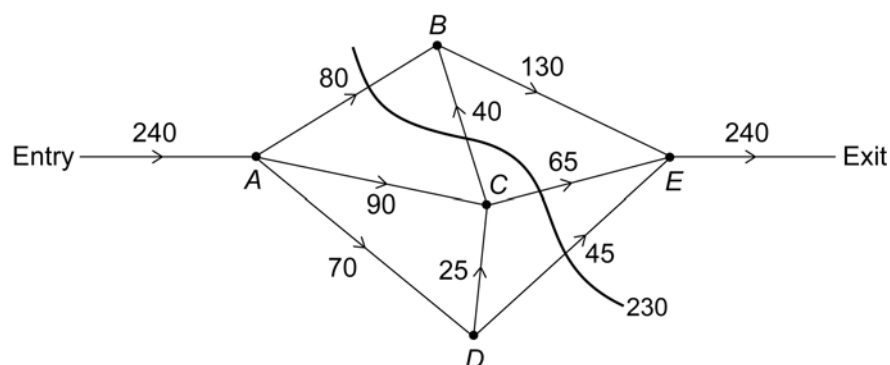
Sample answer:

$$70 + 90 + 130 = 290$$

Question 40 (b)

| Criteria | Marks |
|--|-------|
| <ul style="list-style-type: none"> Provides correct minimum cut and an appropriate recommendation | 2 |
| <ul style="list-style-type: none"> Provides correct minimum cut, or equivalent merit | 1 |

Sample answer:



Increase the flow through CB by 10.

[Other options are possible]

Question 41 (a)

| Criteria | Marks |
|---|-------|
| • Provides correct solution | 3 |
| • Calculates correct actual distance (500 m), or equivalent merit | 2 |
| • Provides a relevant conversion, or equivalent merit | 1 |

Sample answer:

$$3 \text{ km/h} = \frac{3000}{60} \text{ m/min}$$

$$\therefore \text{In 10 minutes walk is } \frac{3000}{60} \times 10 = 500 \text{ m}$$

\therefore scale is

$$5 \text{ cm} = 500 \text{ m}$$

$$\therefore 1 \text{ cm} = 100 \text{ m}$$

Question 41 (b)

| Criteria | Marks |
|---|-------|
| • Provides correct solution | 3 |
| • Calculates correct approximate area using trapezoidal rule, or equivalent merit | 2 |
| • Provides a correct conversion, or equivalent merit | 1 |

Sample answer:

Using scale 1 cm = 100 m for measurements:

$$\text{Area} \div \frac{400}{2}(100 + 300)$$

$$\div 80\,000 \text{ m}^2$$

$$20 \text{ mm} = 0.02 \text{ m}$$

$$\therefore \text{Volume} \div 80\,000 \times 0.02$$

$$\div 1600 \text{ m}^3$$

Question 42

| Criteria | Marks |
|--|-------|
| • Provides correct answer or correct numerical expression | 3 |
| • Provides correct value just before the 7th investment is made, or equivalent merit | 2 |
| • Identifies correct value from the table or equivalent merit | 1 |

Sample answer:

$$\begin{aligned}\text{Total after 6 years} &= 6.633 \times 2000 \\ &= \$13\,266\end{aligned}$$

$$\begin{aligned}\text{After 7th year interest, total} &= 13\,266(1 + 0.05)^1 \\ &= \$13\,929.30\end{aligned}$$

$$\begin{aligned}\therefore \text{Final total} &= 13\,929.30 + 2000 \\ &= \$15\,929.30\end{aligned}$$

2019 HSC Mathematics Standard 2

Mapping Grid

Section I

| Question | Marks | Content | Syllabus outcomes |
|----------|-------|-------------------------------------|-------------------|
| 1 | 1 | MS-M1 Applications of Measurement | MS2-12-4 |
| 2 | 1 | MS-M7 Rates and Ratios | MS2-12-3 |
| 3 | 1 | MS-F4 Investments and Loans | MS2-12-5 |
| 4 | 1 | MS-M6 Non-right angled Trigonometry | MS2-12-3 |
| 5 | 1 | MS-M2 Working with Time | MS2-12-3 |
| 6 | 1 | MS-F1 Money Matters | MS2-12-5 |
| 7 | 1 | MS-F1 Money Matters | MS2-12-5 |
| 8 | 1 | MS-M1 Applications of Measurement | MS2-12-3 |
| 9 | 1 | MS-F1 Money Matters | MS2-12-5 |
| 10 | 1 | MS-S1 Data Analysis | MS2-12-2 |
| 11 | 1 | MS-A1 Formulae and Equations | MS2-12-1 |
| 12 | 1 | MS-M6 Non-right angled Trigonometry | MS2-12-4 |
| 13 | 1 | MS-F4 Investments and Loans | MS2-12-5 |
| 14 | 1 | MS-A4 Types of Relationships | MS2-12-6 |
| 15 | 1 | MS-S5 The Normal Distribution | MS2-12-7 |

Section II

| Question | Marks | Content | Syllabus outcomes |
|----------|-------|--|-------------------|
| 16 | 2 | MS-M1 Applications of Measurement | MS2-12-4 |
| 17 | 3 | MS-M6 Non-right angled Trigonometry | MS2-12-4 |
| 18 (a) | 2 | MS-M7 Rates and Ratios | MS2-12-4 |
| 18 (b) | 2 | MS-M7 Rates and Ratios | MS2-12-4 |
| 19 | 3 | MS-S1 Data Analysis | MS2-12-2 |
| 20 | 2 | MS-S2 Relative Frequency and Probability | MS2-12-2 |
| 21 | 2 | MS-F4 Investments and Loans | MS2-12-5 |
| 22 | 3 | MS-M6 Non-right angled Trigonometry | MS2-12-4 |
| 23 (a) | 1 | MS-S4 Bivariate Data Analysis | MS2-12-7 |
| 23 (b) | 1 | MS-S4 Bivariate Data Analysis | MS2-12-7 |

| Question | Marks | Content | Syllabus outcomes |
|----------|-------|--|-------------------|
| 23 (c) | 1 | MS-S4 Bivariate Data Analysis | MS2-12-2 |
| 24 | 2 | MS-M1 Applications of Measurement | MS2-12-3 |
| 25 | 3 | MS-S2 Relative Frequency and Probability | MS2-12-2 |
| 26 (a) | 3 | MS-N3 Critical path Analysis | MS2-12-8 |
| 26 (b) | 1 | MS-N3 Critical path Analysis | MS2-12-10 |
| 27 | 3 | MS-F4 Investments and Loans | MS2-12-5 |
| 28 | 4 | MS-A1 Formulae and Equations | MS2-12-1 |
| 29 | 2 | MS-F1 Money Matters | MS2-12-5 |
| 30 (a) | 2 | MS-N2 Network Concepts | MS2-12-8 |
| 30 (b) | 1 | MS-N2 Network Concepts | MS2-12-8 |
| 31 (a) | 1 | MS-A4 Types of Relationships | MS2-12-6 |
| 31 (b) | 2 | MS-A4 Types of Relationships | MS2-12-6 |
| 32 | 3 | MS-F1 Money Matters | MS2-12-10 |
| 33 (a) | 1 | MS-M7 Rates and Ratios | MS2-12-3 |
| 33 (b) | 3 | MS-A4 Types of Relationships | MS2-12-6 |
| 34 (a) | 1 | MS-A2 Linear Relationships | MS2-12-6 |
| 34 (b) | 2 | MS-A2 Linear Relationships | MS2-12-6 |
| 35 | 3 | MS-M6 Non-right angled Trigonometry | MS2-12-4 |
| 36 (a) | 1 | MS-A4 Types of Relationships | MS2-12-1 |
| 36 (b) | 3 | MS-A4 Types of Relationships | MS2-12-6 |
| 37 | 3 | MS-F4 Investments and Loans | MS2-12-5 |
| 38 | 2 | MS-S5 The Normal Distribution | MS2-12-7 |
| 39 | 5 | MS-S1 Data Analysis | MS2-12-10 |
| 40 (a) | 1 | MS-N3 Critical Path Analysis | MS2-12-8 |
| 40 (b) | 2 | MS-N3 Critical Path Analysis | MS2-12-8 |
| 41 (a) | 3 | MS-M7 Rates and Ratios | MS2-12-3 |
| 41 (b) | 3 | MS-M7 Rates and Ratios | MS2-12-4 |
| 42 | 3 | MS-F5 Annuities | MS2-12-5 |