

# 2021 HSC Mathematics Standard 2 Marking Guidelines

## Section I

### Multiple-choice Answer Key

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

## Section II

### Question 16

Criteria	Marks
• Provides correct solution	2
• Attempts to use $V = \frac{4}{3}\pi r^3$ , or equivalent merit	1

**Sample answer:**

$$\begin{aligned}
 V &= \frac{1}{2} \times \frac{4}{3} \times \pi \times 2^3 \\
 &= 16.8 \text{ m}^3 \text{ (one decimal place)}
 \end{aligned}$$

### Question 17

Criteria	Marks
• Provides correct solution	2
• Attempts to use $Q_3 + 1.5 \times IQR$ or calculates interquartile range	1

**Sample answer:**

$$\begin{aligned}
 \text{Interquartile range (IQR)} &= Q_3 - Q_1 \\
 &= 10 - 4 \\
 &= 6
 \end{aligned}$$

$$\begin{aligned}
 Q_3 + 1.5 \times IQR &= 10 + 1.5 \times 6 \\
 &= 19
 \end{aligned}$$

20 is an outlier as  $20 > 19$ .

## Question 18

Criteria	Marks
• Provides correct solution	2
• Calculates the amount of fuel used, or equivalent merit	1

**Sample answer:**

$$\begin{aligned}\text{Fuel cost} &= \frac{1560}{100} \times 6.7 \times 1.45 \\ &= \$151.55\end{aligned}$$

## Question 19

Criteria	Marks
• Provides correct solution	2
• Correct substitution into $S = V_0 - Dn$ or equivalent merit	1

**Sample answer:**

$$7500 = V_0 - 5 \times 2300$$

$$\begin{aligned}\therefore \text{Initial value} &= 7500 + 5 \times 2300 \\ &= \$19\,000\end{aligned}$$

## Question 20

Criteria	Marks
• Provides correct solution	3
• Calculates time difference, or equivalent merit	2
• Calculates longitude difference, or equivalent merit	1

**Sample answer:**

Both cities have longitude to the East.

$$\begin{aligned}\text{Longitude difference} &= 151^\circ - 16^\circ \\ &= 135^\circ\end{aligned}$$

$$\begin{aligned}\text{Time difference} &= 135 \div 15 \\ &= 9 \text{ hours}\end{aligned}$$

Sydney is 9 hours ahead of City A.

$\therefore$  Time in Sydney is 2 am Friday.

## Question 21

Criteria	Marks
• Provides correct solution	3
• Calculates interest correctly, or equivalent merit	2
• Calculates the monthly rate of interest, or equivalent merit	1

**Sample answer:**

$$\begin{aligned}\text{Monthly rate of interest} &= \frac{18.75}{12\,500} \times 100\% \\ &= 0.15\%\end{aligned}$$

$$\text{Interest} = 15\,624.20 \times 0.0015 = \$23.44$$

Final row is

7	15 624.20	23.44	500	16 147.64
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## Question 22

Criteria	Marks
• Provides correct solution	3
• Calculates income tax payable, or equivalent merit	2
• Calculates taxable income, or equivalent merit	1

**Sample answer:**

$$\begin{aligned}\text{Taxable income} &= 84\,000 - 900 - 474 \\ &= \$82\,626\end{aligned}$$

$$\begin{aligned}\text{Income tax payable} &= 5092 + 0.325 \times (82\,626 - 45\,000) \\ &= \$17\,320.45\end{aligned}$$

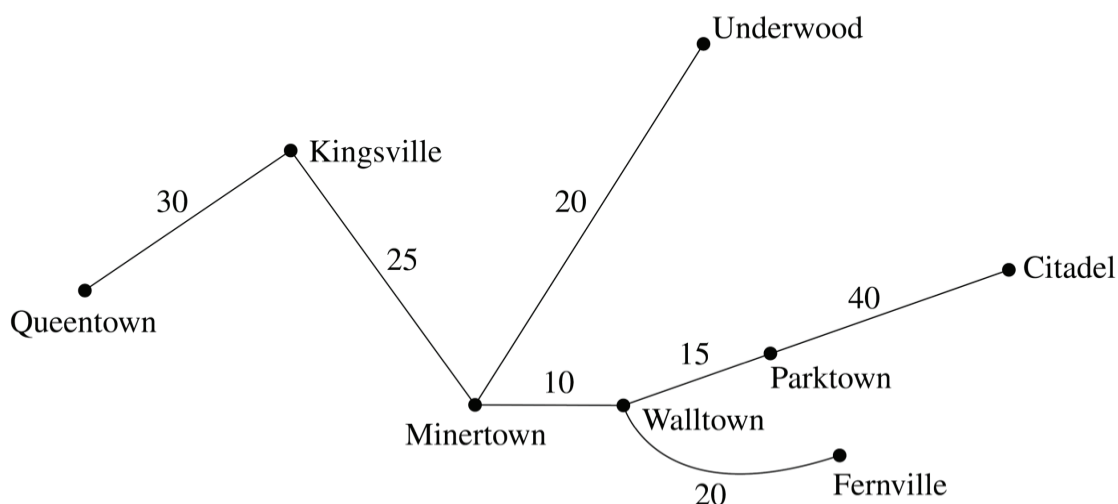
$$\begin{aligned}\text{Medicare levy} &= 0.02 \times 82\,626 \\ &= \$1652.52\end{aligned}$$

$$\begin{aligned}\text{Total to be paid} &= \$17\,320.45 + \$1652.52 \\ &= \$18\,972.97\end{aligned}$$

### Question 23 (a)

Criteria	Marks
• Provides correct solution	3
• Provides a minimum spanning tree or provides a spanning tree (not minimum) and correctly determines its length, or equivalent merit	2
• Provides a spanning tree (not minimum), or equivalent merit	1

**Sample answer:**



Length of minimum spanning tree = 160 minutes

### Question 23 (b)

Criteria	Marks
• Provides correct answer	1

**Sample answer:**

$$\begin{aligned}
 \text{Time} &= 45 + 20 \\
 &= 65 \text{ minutes}
 \end{aligned}$$

### Question 24 (a)

Criteria	Marks
• Provides correct answer	1

**Sample answer:**

When  $t = 0$

$$\begin{aligned} P &= 2000(1.2)^0 \\ &= 2000 \end{aligned}$$

### Question 24 (b)

Criteria	Marks
• Provides correct answer	1

**Sample answer:**

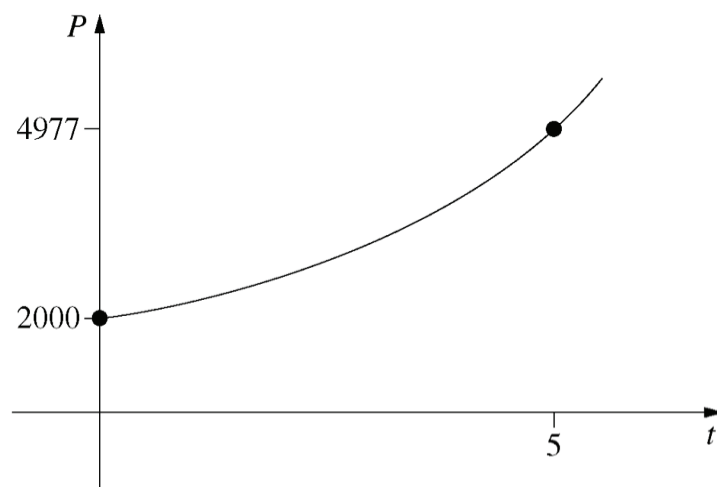
When  $t = 5$

$$\begin{aligned} P &= 2000(1.2)^5 \\ &= 4977 \text{ (nearest integer)} \end{aligned}$$

### Question 24 (c)

Criteria	Marks
• Provides correct graph	2
• Draws an exponential function with positive slope, or equivalent merit	1

**Sample answer:**



## Question 25

Criteria	Marks
• Provides correct solution	4
• Finds the distance Kerry walked and a correct expression for speed not in km/h, or equivalent merit	3
• Finds the distance Kerry walked, or equivalent merit	2
• Calculates the perimeter as 26 (cm), or equivalent merit	1

### **Sample answer:**

$$\begin{aligned}\text{Perimeter of diagram} &= 2 \times (8 + 5) \\ &= 26 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Actual perimeter} &= 26 \times 3000 \text{ cm} \\ &= 78\,000 \text{ cm} \\ &= 780 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Speed} &= \frac{780}{12} = 65 \text{ m/minute} \\ &= \frac{65 \times 60}{1000} \text{ km/hour} \\ &= 3.9 \text{ km/hour}\end{aligned}$$

### Question 26 (a)

Criteria	Marks
• Provides correct solution	2
• Attempts to use compound interest formula with correct interest rate or correct number of periods, or equivalent merit	1

**Sample answer:**

$$6\% \div 12 = 0.5\% \text{ per month}$$

$$\begin{aligned} \text{Future value of Option A} &= 35\,000(1 + 0.005)^{12} \\ &= \$37\,158.72 \end{aligned}$$

### Question 26 (b)

Criteria	Marks
• Provides correct solution	2
• Correct substitution into the simple interest formula, or equivalent merit	1

**Sample answer:**

$$\begin{aligned} \text{Interest in Option A} &= \$37\,158.72 - \$35\,000 \\ &= \$2158.72 \end{aligned}$$

$$2158.72 = 35\,000 \times \frac{r}{100} \times 1$$

$$r = 6.17 \text{ (two decimal places)}$$



**Question 27 (a)**

Criteria	Marks
• Provides correct solution	2
• Finds the power usage for Television <i>B</i> for one year, or equivalent merit	1

**Sample answer:**

$$160 \times 3 \times 365 \div 1000 = 175.2 \text{ kW}$$

$$175.2 \text{ kW} \times 0.25 = \$43.80$$

$$\begin{aligned} \text{Saving in electricity} &= 48.18 - 43.80 \\ &= \$4.38 \end{aligned}$$

**Question 27 (b)**

Criteria	Marks
• Provides correct solution	2
• Calculates \$21.90, or equivalent merit	1

**Sample answer:**

$$\begin{aligned} \text{Saving if Television A is purchased} \\ &= 921.90 - 900 \\ &= \$21.90 \end{aligned}$$

$$\begin{aligned} \text{Number of years} &= 21.90 \div 4.38 \\ &= 5 \text{ years} \end{aligned}$$

### Question 28 (a)

Criteria	Marks
• Provides correct answer	2
• Finds the intercept or finds the gradient or writes down a linear equation	1

**Sample answer:**

Using the graph, the least-squares regression line has gradient  $= \frac{18 - 2}{5 - 0}$   
 $= 3.2$

The equation of the least-squares regression line is  $y = 2 + 3.2x$ .

### Question 28 (b)

Criteria	Marks
• Provides correct answer	1

**Sample answer:**

It would increase.

### Question 29

Criteria	Marks
• Provides correct solution	2
• Writes fraction using a common denominator, or equivalent merit	1

**Sample answer:**

$$x + \frac{x-1}{2} = 9$$

$$2x + x - 1 = 18$$

$$3x = 19$$

$$x = \frac{19}{3}$$

### Question 30

Criteria	Marks
• Provides correct solution	2
• Calculates total value of shares or calculates the dividend per share, or equivalent merit	1

**Sample answer:**

$$\text{Dividend for 1 share: } \frac{810}{1500} = \$0.54$$

$$\begin{aligned} \therefore \text{Dividend yield} &= \frac{0.54}{27} \times 100\% \\ &= 2\% \end{aligned}$$

### Question 31

Criteria	Marks
• Provides correct solution	2
• Identifies the correct present value interest factor or divides 500 000 by any value	1

**Sample answer:**

$$\begin{aligned} \text{Monthly rate of interest} &= \frac{0.015}{12} \\ &= 0.00125 \end{aligned}$$

$$\begin{aligned} \text{Monthly payment} &= \frac{500\,000}{289.75411} \\ &= \$1725.60 \text{ (nearest cent)} \end{aligned}$$

### Question 32 (a)

Criteria	Marks
• Provides correct solution	2
• Uses correct trigonometric ratio, or equivalent merit	1

**Sample answer:**

In  $\triangle XYZ$

$$\cos 30^\circ = \frac{XY}{16}$$

$$XY = 13.86 \text{ cm (two decimal places)}$$

### Question 32 (b)

Criteria	Marks
• Provides correct solution	3
• Calculates the area of $\triangle XYZ$ and the semicircle or equivalent merit	2
• Calculates the area of a semicircle, or equivalent merit	1

**Sample answer:**

$$\text{Shaded area} = \frac{1}{2}\pi(8)^2 - \frac{1}{2} \times 13.86 \times 16 \times \sin 30^\circ$$

$$= 45.1 \text{ cm}^2 \text{ (one decimal place)}$$

### Question 33 (a) (i)

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

**Sample answer:**

$$\begin{aligned}
 y &= 29.2 - 0.011 \times 540 \\
 &= 23.3^{\circ}\text{C}
 \end{aligned}$$

### Question 33 (a) (ii)

Criteria	Marks
<ul style="list-style-type: none"> <li>Provides correct solution</li> </ul>	2
<ul style="list-style-type: none"> <li>Provides a correct relevant statement relating temperature to height above sea level or equivalent merit</li> </ul>	1

**Sample answer:**

For a one metre increase in the height above sea level, we expect a  $0.011^{\circ}\text{C}$  drop in average maximum daily temperature.

### Question 33 (b)

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

**Sample answer:**

It would be better to use the latitude. From the information given, the average maximum daily temperature has a stronger correlation with latitude than with height above sea level.

## Question 34

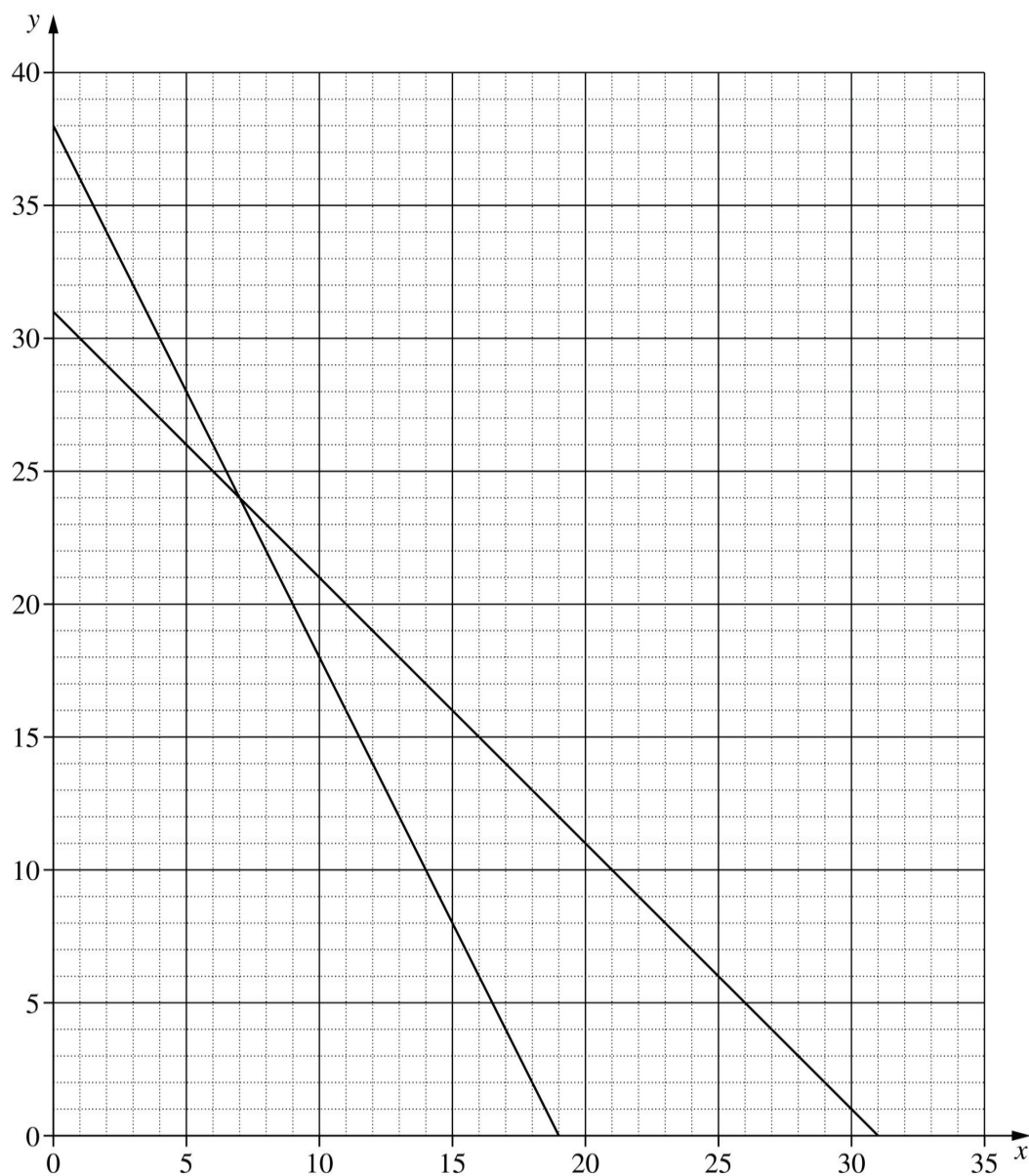
Criteria	Marks
• Provides correct solution	4
• States the other relevant correct equation and graphs two equations correctly, or equivalent merit	3
• States the other relevant correct equation and graphs one equation correctly, or equivalent merit	2
• States the other relevant correct equation, or equivalent merit	1

**Sample answer:**

$$4x + 2y = 76$$

$$\therefore 2x + y = 38$$

$\therefore$  7 goannas and 24 emus



### Question 35 (a)

Criteria	Marks
• Provides correct solution	2
• Finds $x = 45$ , or equivalent merit	1

**Sample answer:**

By symmetry, to maximise revenue, choose  $x = 45$ .

$$45 + 10 = 55$$

Then, price is \$55 in order to maximise the revenue.

### Question 35 (b)

Criteria	Marks
• Provides correct answer	1

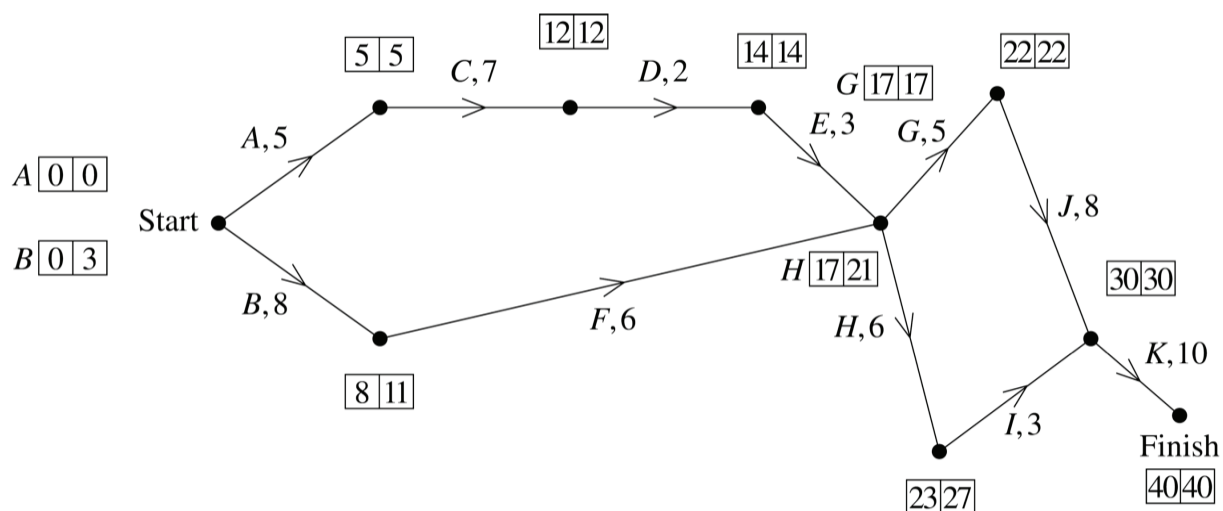
**Sample answer:**

Intercept is 50 000.

### Question 36 (a)

Criteria	Marks
• Provides correct answer	1

**Sample answer:**



40 minutes

### Question 36 (b)

Criteria	Marks
• Provides correct answer	1

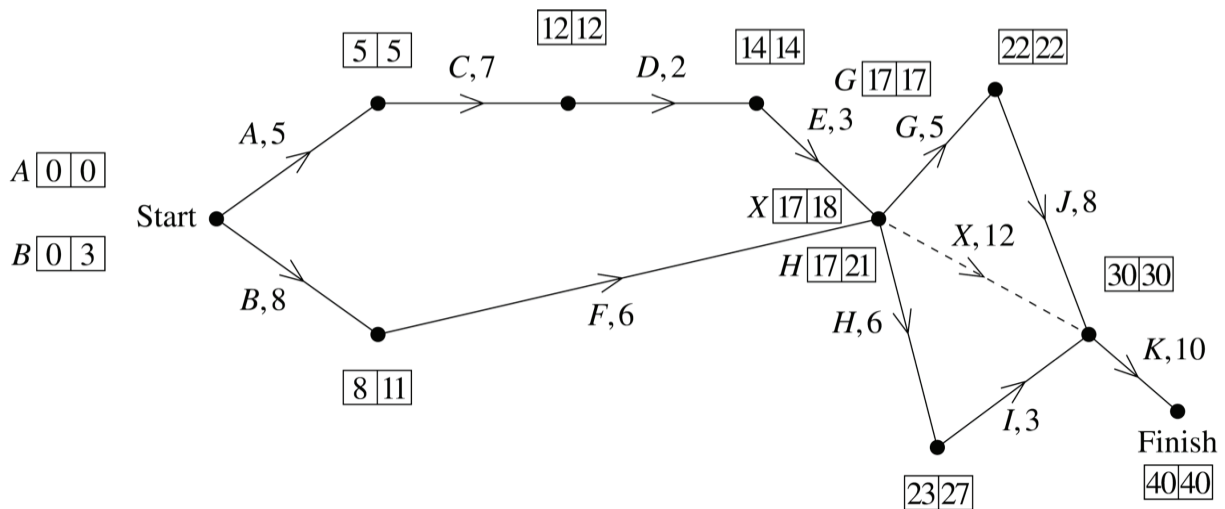
**Sample answer:**

$A - C - D - E - G - J - K$

### Question 36 (c)

Criteria	Marks
• Provides correct solution	2
• States the float time or adds $X$ to the network diagram	1

**Sample answer:**



Task  $X$  is labelled on the diagram as above.

Float time for task  $X$  is 1 minute.



### Question 37

Criteria	Marks
• Provides correct solution	3
• Calculates $47.18^\circ$ , or equivalent merit	2
• Substitutes into the sine rule correctly, or equivalent merit	1

**Sample answer:**

$$\frac{\sin \hat{A}BC}{25} = \frac{\sin 28^\circ}{16}$$

$$\therefore \sin \hat{A}BC = 0.733\dots$$

$$\begin{aligned}\therefore \hat{A}BC &= 180^\circ - 47.18\dots^\circ \\ &= 133^\circ \text{ (nearest degree)}\end{aligned}$$

### Question 38 (a)

Criteria	Marks
• Provides correct solution	1

**Sample answer:**

$$\begin{aligned}\text{Probability} &= 0.5 - 0.1179 \\ &= 0.3821\end{aligned}$$

### Question 38 (b)

Criteria	Marks
• Provides correct solution	3
• Calculates z-score and uses associated probability, or equivalent merit	2
• Calculates z-score, or equivalent merit	1

**Sample answer:**

$$\begin{aligned}z &= \frac{3471 - 3300}{570} \\ &= 0.3\end{aligned}$$

From part (a),  $P(Z > 0.3) = 0.3821$

$\therefore$  Expect  $1000 \times 0.3821 = 382.1$  babies born to have a birth weight greater than 3471 grams.

### Question 39 (a)

Criteria	Marks
• Provides correct solution	2
• Substitutes correctly into $\text{Area} = \frac{1}{2}ab\sin C$ , or equivalent merit	1

**Sample answer:**

$$466 = \frac{1}{2} \times 28 \times 35 \times \sin \hat{C}OB$$

$$\therefore \sin \hat{C}OB = 0.95102\dots$$

$$\therefore \hat{C}OB = 72^\circ \text{ (nearest degree)}$$

### Question 39 (b)

Criteria	Marks
• Provides correct solution	3
• Finds the length of $CD$ , or equivalent merit	2
• Finds angle $DOC$ , or equivalent merit	1

**Sample answer:**

$$\begin{aligned} \hat{D}OC &= 330^\circ - 150^\circ - 72^\circ \\ &= 108^\circ \end{aligned}$$

$$\begin{aligned} CD^2 &= 31^2 + 28^2 - 2 \times 31 \times 28 \times \cos 108^\circ \\ &= 2281.45\dots \end{aligned}$$

$$\therefore CD = 47.76$$

$$\begin{aligned} \therefore \text{Fencing required} &= 31 + 28 + 47.76\dots \\ &= 106.8 \text{ m (one decimal place)} \end{aligned}$$

**Question 40**

Criteria	Marks
• Provides correct solution	3
• Finds the correct future value of the annuity and attempts to apply the compound interest formula, or equivalent merit	2
• Identifies the correct interest factor from the table, or equivalent merit	1

**Sample answer:**

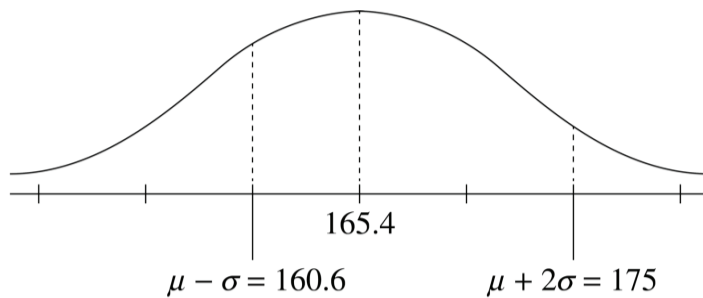
$$\begin{aligned}\text{Money in account after 8 years} &= 1000 \times 8.2132 \\ &= \$8213.20\end{aligned}$$

$$\begin{aligned}\text{Amount after 2 more years} &= 8213.20 (1.0125)^2 \\ &= \$8419.81\end{aligned}$$

## Question 41

Criteria	Marks
• Provides correct solution	4
• Finds the mean and standard deviation for the heights of adult males, or equivalent merit	3
• Finds $\sigma$ , or equivalent merit	2
• Labels the diagram, or equivalent merit	1

**Sample answer:**



$$\sigma = \frac{175 - 160.6}{3}$$

$$= 4.8$$

$$\mu = 160.6 + 4.8$$

$$= 165.4$$

Selected male is taller than 84% of population

$\therefore$  Selected male is 1 standard deviation above mean.

$$\text{Mean height for males} = 1.05 \times 165.4 = 173.67$$

$$\text{Standard deviation of height for males} = 4.8 \times 1.1 = 5.28$$

$$\therefore \text{Height} = 1.05\mu + 1.1\sigma$$

$$= 173.67 + 5.28$$

$$= 178.95 \text{ cm}$$

# 2021 HSC Mathematics Standard 2 Mapping Grid

## Section I

Question	Marks	Content	Syllabus outcomes
1	1	MS-M1 Applications of Measurement	MS11-4
2	1	MS-N2 Network Concepts	MS2-12-8
3	1	MS-S1 Data Analysis	MS11-7
4	1	MS-F4 Investments and Loans	MS2-12-5
5	1	MS-F4 Investments and Loans	MS2-12-5
6	1	MS-A1 Formulae and Equations	MS11-1
7	1	MS-S1 Data Analysis	MS11-2
8	1	MS-S5 The Normal Distribution	MS2-12-7
9	1	MS-A1 Formulae and Equations	MS11-1
10	1	MS-A4 Types of Relationships	MS2-12-6
11	1	MS-S2 Relative Frequency and Probability	MS11-8
12	1	MS-M1 Applications of Measurement	MS11-4
13	1	MS-A4 Types of Relationships	MS2-12-6
14	1	MS-M6 Non-right-angled Trigonometry	MS2-12-4
15	1	MS-M7 Rates and Ratios	MS2-12-10

## Section II

Question	Marks	Content	Syllabus outcomes
16	2	MS-M1 Applications of Measurement	MS11-4
17	2	MS-S1 Data Analysis	MS11-7
18	2	MS-M7 Rates and Ratios	MS2-12-3
19	2	MS-F1 Money Matters	MS11-5
20	3	MS-M2 Working with Time	MS11-3
21	3	MS-F5 Annuities	MS2-12-9
22	3	MS-F1 Money Matters	MS11-10
23 (a)	3	MS-N2 Network Concepts	MS2-12-8
23 (b)	1	MS-N2 Network Concepts	MS2-12-8
24 (a)	1	MS-A4 Types of Relationships	MS2-12-1
24 (b)	1	MS-A4 Types of Relationships	MS2-12-1

Question	Marks	Content	Syllabus outcomes
24 (c)	2	MS-A4 Types of Relationships	MS2-12-6
25	4	MS-M1 Applications of Measurement	MS2-12-3
26 (a)	2	MS-F4 Investments and Loans	MS2-12-5
26 (b)	2	MS-F4 Investments and Loans	MS2-12-5
27 (a)	2	MS-M7 Rates and Ratios	MS2-12-3
27 (b)	2	MS-A1 Formulae and Equations	MS11-6
28 (a)	2	MS-S4 Bivariate Data Analysis	MS2-12-9
28 (b)	1	MS-S4 Bivariate Data Analysis	MS2-12-7
29	2	MS-A1 Formulae and Equations	MS11-1
30	2	MS-F4 Investments and Loans	MS2-12-5
31	2	MS-F5 Annuities	MS2-12-5
32 (a)	2	MS-M6 Non-right-angled Trigonometry	MS2-12-4
32 (b)	3	MS-M6 Non-right-angled Trigonometry	MS2-12-4
33 (a) (i)	1	MS-S4 Bivariate Data Analysis	MS2-12-2
33 (a) (ii)	2	MS-S4 Bivariate Data Analysis	MS2-12-2
33 (b)	1	MS-S4 Bivariate Data Analysis	MS2-12-2
34	4	MS-A4 Types of Relationships	MS2-12-6
35 (a)	2	MS-A4 Types of Relationships	MS2-12-6
35 (b)	1	MS-A4 Types of Relationships	MS2-12-1
36 (a)	1	MS-N3 Critical Path Analysis	MS2-12-8
36 (b)	1	MS-N3 Critical Path Analysis	MS2-12-8
36 (c)	2	MS-N3 Critical Path Analysis	MS2-12-8
37	3	MS-M6 Non-right-angled Trigonometry	MS2-12-3; MS2-12-4
38 (a)	1	MS-S5 The Normal Distribution	MS2-12-7
38 (b)	3	MS-S5 The Normal Distribution	MS2-12-7
39 (a)	2	MS-M6 Non-right-angled Trigonometry	MS2-12-4
39 (b)	3	MS-M6 Non-right-angled Trigonometry	MS2-12-4
40	3	MS-F5 Annuities MS-F4 Investments and Loans	MS2-12-5
41	4	MS-S5 The Normal Distribution	MS2-12-7