2022 HSC Mathematics Advanced
Marking Guidelines

Section I

Multiple-choice Answer Key

Question	Answer
1	A
2	D
3	B
4	A
5	D
6	B
7	C
8	C
9	A
10	B

Section II

Question 11 (a)

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

Sample answer:

$\boldsymbol{A} = 98 + 62 = 160$

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

Question 11 (b)

Criteria	Marks
• Provides correct answer	1

Sample answer:

Stock shortage and delivery fee

Question 12 (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 $T = 15$ $\quad M = 12$

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

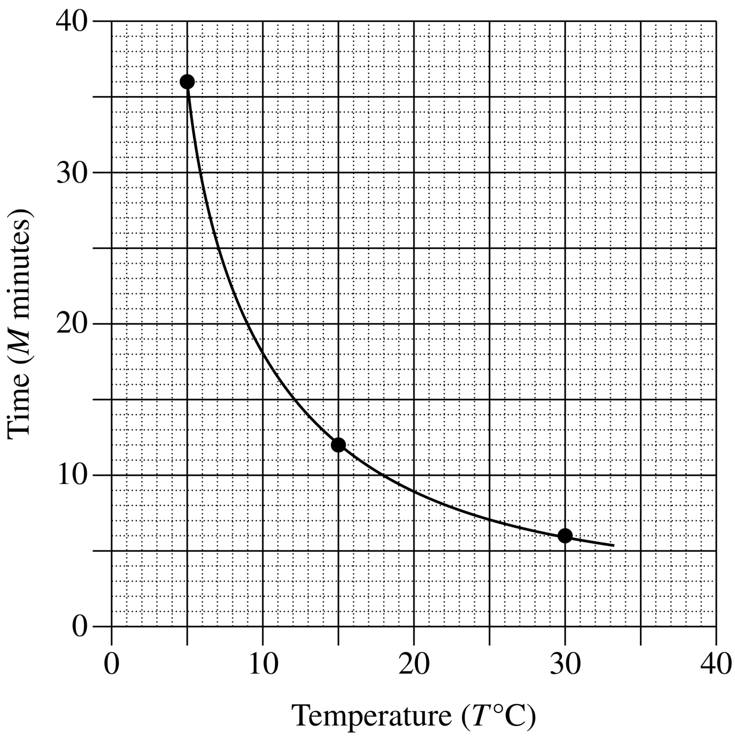
$$k = 15 \times 12 = 180$$

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

Question 12 (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 13

Criteria	Marks
• Provides correct solution	2
• Finds function values at 0 and 2, or equivalent merit	1

Sample answer:

$$\int_0^2 \sqrt{1+x^2}\,dx$$

x	0	1	2
$\sqrt{1+x^2}$	1	1.414	2.236

$$\int_0^2 \sqrt{1+x^2}\,dx = \frac{1}{2}[1+1.414]+\frac{1}{2}[1.414+2.236]$$

$$= 3.03 \text{ (2 decimal places)}$$

Question 14

Criteria	Marks
• Provides the values of *k* and *a*	2
• Finds the value of *k* or *a*, or equivalent merit	1

Sample answer:

k = amplitude = 4

$$\text{Period} = \frac{2\pi}{a}$$

$$6\pi = \frac{2\pi}{a}$$

$$\therefore \quad a = \frac{1}{3}$$

Question 15 (a)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$P(5) = \frac{2}{3} \times \frac{1}{6} + \frac{1}{3} \times \frac{3}{6}$$

$$= \frac{5}{18}$$

Question 15 (b)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$P(\text{special die} \mid 5) = \frac{P(\text{special die } \cap 5)}{P(5)}$$

$$= \frac{\frac{1}{3} \times \frac{3}{6}}{\frac{5}{18}}$$

$$= \frac{3}{5}$$

Question 16

Criteria	Marks
• Provides correct solution	3
• Provides correct anti-derivative, or equivalent merit	2
• Provides an integral expression for area, or equivalent merit	1

Sample answer:

$$A = \int_{-1}^{3} 2x + 3 - x^2 \, dx$$

$$= \left[x^2 + 3x - \frac{x^3}{3} \right]_{-1}^{3}$$

$$= (9 + 9 - 9) - \left(1 - 3 + \frac{1}{3}\right)$$

$$\text{Area} = 10\frac{2}{3} \text{ units}^2$$

Question 17 (a)

Criteria	Marks
• Provides correct solution	2
• Finds the values of *a* and *d*, or equivalent merit	1

Sample answer:

Number of cards $= 3 + 6 + 9 + \cdots$ (12 terms)

$$S_{12} = \frac{12}{2}(2 \times 3 + 11 \times 3) \qquad \left(\begin{array}{ll}\text{arithmetic series} & S_n = \frac{n}{2}(2a + (n-1)d) \\ & a = 3 \quad d = 3\end{array}\right)$$

$$= 234$$

Question 17 (b)

Criteria	Marks
• Provides correct solution	3
• Finds correct quadratic expression	2
• Correctly substitutes *a*, *d* and 828 into formula for S_n, or equivalent merit	1

Sample answer:

Let n = number of rows

$$\frac{n}{2}(2 \times 3 + (n-1)3) = 828$$

$$n(3n+3) = 1656$$

$$3n(n+1) = 1656$$

$$n^2 + n = 552$$

$$n^2 + n - 552 = 0$$

$$n = \frac{-1 \pm \sqrt{1^2 - 4 \times -552}}{2}$$

$$= \frac{-1 \pm 47}{2}$$

$$= 23 \text{ (taking positive solution)}$$

There are 23 rows.

Question 18 (a)

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

Sample answer:

$$y = \left(x^2 + 1\right)^4$$

$$\frac{dy}{dx} = 4\left(x^2 + 1\right)^3 \times 2x$$

$$= 8x\left(x^2 + 1\right)^3$$

Question 18 (b)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\int x\left(x^2 + 1\right)^3 dx$$

$$= \frac{1}{8}\int 8x\left(x^2 + 1\right)^3 dx$$

$$= \frac{1}{8}\left(x^2 + 1\right)^4 + c \qquad \text{from part (a)}$$

Question 19

Criteria	Marks
• Provides correct solution	3
• Writes $g(x)$ in terms of m and k, and finds value of k, or equivalent merit	2
• Writes $g(x)$ in terms of m and k, or equivalent merit	1

Sample answer:

$$\begin{aligned} g(x) &= k(x-m)^2 - 5 \\ &= k\left(x^2 - 2xm + m^2\right) - 5 \\ &= kx^2 - 2mkx + m^2k - 5 \end{aligned}$$

By inspection $\quad k = 3$

By equating coefficient of x

$$\begin{aligned} 2mk &= 12 \\ 6m &= 12 \\ m &= 2 \end{aligned}$$

ALTERNATE SOLUTION

$$\begin{aligned} g(x) &= k(x-m)^2 - 5 \\ g(x) &= 3x^2 - 12x + 7 \\ &= 3\left(x^2 - 4x\right) + 7 \\ &= 3\left(x^2 - 4x + 4\right) + 7 - 12 \\ &= 3(x-2)^2 - 5 \end{aligned}$$

So $k = 3$ and $m = 2$

Question 20 (a)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\begin{aligned} N(0) &= 200e^{0} \\ &= 200 \end{aligned}$$

Question 20 (b)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\begin{aligned} N(24) &= 200e^{0.013\times 24} \\ &= 273.23\ldots \\ &\approx 273 \text{ bacteria} \end{aligned}$$

Question 20 (c)

Criteria	Marks
• Provides correct answer	2
• Attempts to find $\frac{dN}{dt}$	1

Sample answer:

$$\frac{dN}{dt} = 200 \times 0.013 \times e^{0.013t}$$

When $t = 24$ $\quad \frac{dN}{dt} = 0.013 \times 273$ $\quad$ from part (b)

$$= 3.55$$

Rate of increase = 3.55 bacteria/hour.

Question 21 (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:

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

$$\begin{aligned} FV &= 40\ 000\left(1 + \frac{0.012}{12}\right)^{120} \\ &= \$45\ 097.17 \end{aligned}$$

Question 21 (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 $\implies$ $N = 10 \times 4 = 40$

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

From table: 45.05630

So $\quad FV = 45.05630 \times 1000$

$\qquad\quad = 45\ 056.30$

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

Question 22

Criteria	Marks
• Provides correct solution	4
• Finds the *y* values for at least 3 relevant points	3
• Solves the quadratic to find *x* coordinates of stationary points	2
• Finds the derivative, or equivalent merit	1

Sample answer:

Global maximum and minimum values occur at local maximum and minimum or end points of the interval.

$y = x^3 - 6x^2 + 8$

$\dfrac{dy}{dx} = 3x^2 - 12x$

$\dfrac{dy}{dx} = 0 \quad \Longrightarrow \quad 3x^2 - 12x = 0$

$3x(x - 4) = 0$

Stationary points at $x = 0$ and $x = 4$

When $x = 0 \quad y = 8$

When $x = 4 \quad y = -24$

End points of interval

When $x = -1 \quad y = 1$

When $x = 7 \quad y = 57$

Global minimum value $= -24$

Global maximum value $= 57$

Question 23 (a)

Criteria	Marks
• Provides correct solution	2
• Finds the depth of water at either high or low tide, or equivalent merit	1

Sample answer:

$$d = 1.3 - 0.6\cos\left(\frac{4\pi}{25}t\right)$$

Maximum depth (*high tide*) $= 1.3 + 0.6 = 1.9$ m

Minimum depth (*low tide*) $= 1.3 - 0.6 = 0.7$ m

Question 23 (b)

Criteria	Marks
• Provides correct answer	1

Sample answer:

$$\text{Period} = \frac{2\pi}{\left(\frac{4\pi}{25}\right)} \text{ hours}$$

$$= 12.5 \text{ hours}$$

Question 23 (c)

Criteria	Marks
• Provides correct solution	3
• Finds one value of t for d = 1, or equivalent merit	2
• Attempts to solve the given equation when d = 1	1

Sample answer:

$$d = 1.3 - 0.6\cos\left(\frac{4\pi}{25}t\right)$$

$$1 = 1.3 - 0.6\cos\left(\frac{4\pi}{25}t\right), \qquad \text{when } d = 1$$

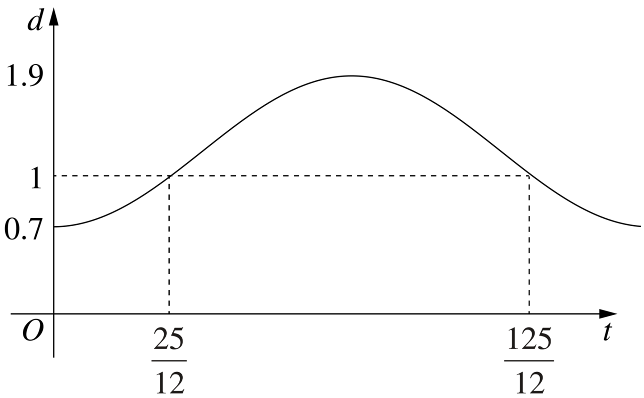
$$-0.3 = -0.6\cos\left(\frac{4\pi}{25}t\right)$$

$$\frac{1}{2} = \cos\left(\frac{4\pi}{25}t\right)$$

$$\frac{4\pi}{25}t = \frac{\pi}{3}, \ \frac{5\pi}{3}$$

$$t = \frac{\pi}{3}\times\frac{25}{4\pi}, \ \frac{5\pi}{3}\times\frac{25}{4\pi}$$

$$= \frac{25}{12}, \ \frac{125}{12}$$



$$\text{Time interval } = \frac{125}{12} - \frac{25}{12}$$

$$= 8\frac{1}{3} \text{ hours}$$

Question 24

Criteria	Marks
• Provides a comprehensive description and interpretation of the data and other information, in the given context	4
• Provides a sound description and interpretation of the data and other information, in the given context	3
• Provides some description and interpretation of the data and/or other information	2
• 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 weaker/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 25

Criteria	Marks
• Provides correct solution	3
• Finds the values of x, $0 < x < \pi$, for each derivative equation	2
• Attempts to find a value for x that solves $f'(x)$ or $f''(x)$, or equivalent merit	1

Sample answer:

$$f(x) = \sin 2x$$

$$f'(x) = 2\cos 2x$$

$$f''(x) = -4\sin 2x$$

$$f'(x) = -\sqrt{3} \quad \Rightarrow \quad 2\cos 2x = -\sqrt{3}$$

$$\cos 2x = \frac{-\sqrt{3}}{2} \qquad 0 < 2x < 2\pi$$

$$2x = \frac{5\pi}{6}, \frac{7\pi}{6}$$

$$x = \frac{5\pi}{12}, \frac{7\pi}{12}$$

$$f''(x) = 2 \quad \Rightarrow \quad -4\sin 2x = 2$$

$$\sin 2x = \frac{-1}{2} \qquad 0 < 2x < 2\pi$$

$$2x = \frac{7\pi}{6}, \frac{11\pi}{6}$$

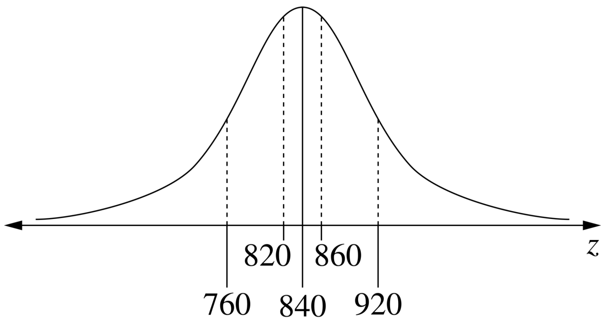
$$x = \frac{7\pi}{12}, \frac{11\pi}{12}$$

$$\therefore\ x = \frac{7\pi}{12} \text{ for } 0 < x < \pi$$

Question 26

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.

∴ 10% have a life span between 840 and 860.

∴ 10% have a life span between 820 and 840.

68% have a life span between 760 and 920.

∴ 34% have a life span between 840 and 920.

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

Question 27 (a)

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

Sample answer:

$$f'(x) = e^{-2x} - 2xe^{-2x}$$

$$f''(x) = -2e^{-2x} - 2\left(x \times -2e^{-2x} + e^{-2x}\right)$$

$$= -2e^{-2x} + 4xe^{-2x} - 2e^{-2x}$$

$$= (4x - 4)e^{-2x}$$

$$= 4(x - 1)e^{-2x}$$

Question 27 (b)

Criteria	Marks
• Provides correct solution	2
• Finds the *x* value of the stationary point	1

Sample answer:

Stationary points where $f'(x) = 0$

$$(1 - 2x)e^{-2x} = 0$$

$$x = \frac{1}{2}, \qquad \text{since } e^{-2x} \neq 0, \qquad f\left(\frac{1}{2}\right) = \frac{1}{2}e^{-1} = \frac{1}{2e}$$

$$f''\left(\frac{1}{2}\right) = 4 \times -\frac{1}{2} \times e^{-1} = -2e^{-1} < 0$$

$\therefore \left(\frac{1}{2}, \frac{1}{2e}\right)$ is a local maximum.

Question 27 (c)

Criteria	Marks
• Provides correct graph	3
• Sketches the curve showing most of the main features	2
• Provides a sketch showing the stationary point and 1 other feature	1

Sample answer:

Possible point of inflection where $f''(x) = 0$

$4(x-1)e^{-2x} = 0$

$\therefore x = 1, \quad$ since $e^{-2x} \neq 0$

x	0	1	2
$f''(x)$	-4	0	$4e^{-4}$

Changes concavity at $x = 1$

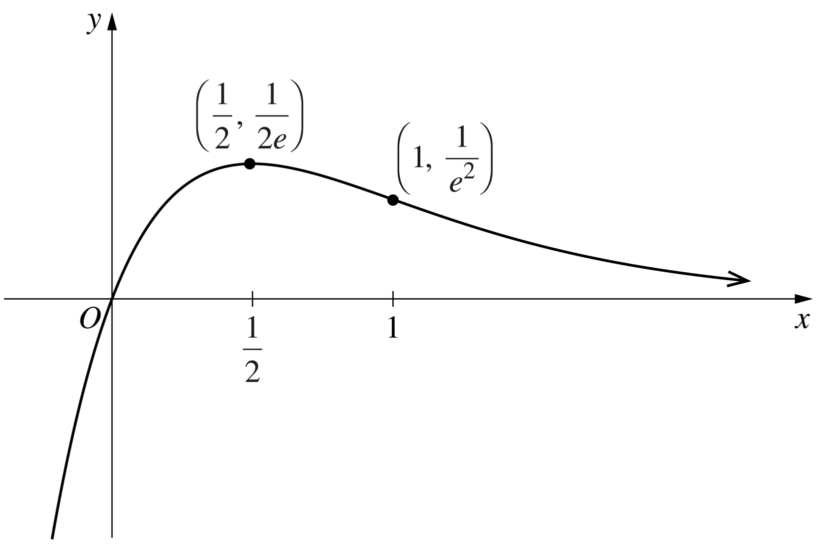
$\therefore$ Inflection point at $x = 1$

$$\begin{aligned} f(1) &= 1e^{-2\times 1} \\ &= e^{-2} \end{aligned}$$

$\left(1, \dfrac{1}{e^2}\right)$ — Inflection point

$f(0) = 0 \quad \therefore$ graph passes through $(0, 0)$

As $x \to \infty, \quad f(x) \to 0$

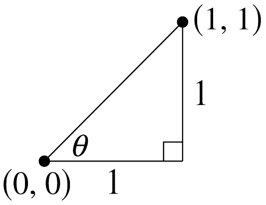


Question 28 (a)

Criteria	Marks
• Provides correct solution	2
• Finds area of the sector	1

Sample answer:

Area = Area sector − Area triangle



$\theta = \dfrac{\pi}{4}$

$$\begin{aligned} \text{Area } &= \frac{1}{2}r^2\theta - \frac{1}{2}\times 1\times 1 \\ &= \frac{1}{2}\left(\sqrt{2}\right)^2 \times \frac{\pi}{4} - \frac{1}{2} \\ &= \frac{\pi}{4} - \frac{1}{2} \end{aligned}$$

Question 28 (b)

Criteria	Marks
• Provides correct solution	2
• Shows that $a = b$	1

Sample answer:

Substitute $x = y = 0$

$$0 = \frac{a}{b} - 1 \qquad \therefore \frac{a}{b} = 1$$

$$\therefore a = b$$

Substitute $x = y = 1$

$$1 = \frac{a}{b-1} - 1$$

$$1 = \frac{a}{a-1} - 1$$

$$\frac{a}{a-1} = 2$$

$$a = 2a - 2$$

$$\therefore a = 2 \qquad \therefore b = 2$$

Question 28 (c)

Criteria	Marks
• Provides correct solution	3
• Correctly evaluates integral	2
• Gives the area as a sum of an integral and the area from part (a), or equivalent merit	1

Sample answer:

$$\text{Area under curve (hyperbola)} = \int_0^1 \left(\frac{2}{2-x} - 1\right) dx$$

$$= \left[-2\ln(2-x) - x\right]_0^1$$

$$= -2\ln 1 - 1 + 2\ln 2 - 0$$

$$= 2\ln 2 - 1$$

$$\text{Total area} = 2\ln 2 - 1 + \frac{\pi}{4} - \frac{1}{2} \text{ (units}^2\text{)}$$

$$= 2\ln 2 + \frac{\pi}{4} - \frac{3}{2} \text{ (units}^2\text{)}$$

Question 29 (a)

Criteria	Marks
• Shows the limiting sum	1

Sample answer:

Limiting sum $= 2^0 + 2^{-1} + 2^{-2} + \cdots$

$$S = \frac{a}{1-r}, \quad \text{where } a = 1 \text{ and } r = \frac{1}{2}$$

$$= \frac{1}{1-\frac{1}{2}}$$

$$= 2$$

Question 29 (b)

Criteria	Marks
• Provides correct solution	2
• Substitutes correctly into anti-derivative, or equivalent merit	1

Sample answer:

$$\int_0^4 2^{-x}\,dx = \left[\frac{-1}{\ln 2}2^{-x}\right]_0^4 \qquad \text{(using the reference sheet)}$$

$$= \frac{-1}{\ln 2}\left[2^{-4} - 2^0\right]$$

$$= \left(1 - \frac{1}{16}\right)\frac{1}{\ln 2} = \frac{15}{16\ln 2}$$

Question 29 (c)

Criteria	Marks
• Provides correct solution	2
• Sets up correct inequality, or equivalent merit	1

Sample answer:

Limiting sum of rectangles > area under curve between 0 and 4

$\therefore \quad \dfrac{15}{16\ln 2} < 2$ area under the curve between 0 and 4 < limiting sum of rectangles

$\therefore \quad 15 < 32\ln 2$

$\therefore \quad 15 < \ln\left(2^{32}\right)$

$\therefore \quad e^{15} < 2^{32}$

Question 30 (a)

Criteria	Marks
• Provides correct solution	1

Sample answer:

We need $F\left(e^3\right) = 1$, since $F(x)$ is a CDF

$$F\left(e^3\right) = \frac{1}{k}\ln e^3$$

$$= \frac{3}{k}$$

So $\dfrac{3}{k} = 1$

$\therefore \quad k = 3$

Question 30 (b)

Criteria	Marks
• Provides correct solution	2
• Recognises that $P(X > c) = 1 - P(X < c)$, or equivalent merit	1

Sample answer:

$$P(X > c) = 1 - P(X < c)$$

$$P(X < c) = 2\left[1 - P(X < c)\right]$$

$$3P(X < c) = 2$$

$$P(X < c) = \frac{2}{3}$$

$$\therefore \quad F(c) = \frac{2}{3}$$

$$\frac{1}{3}\ln c = \frac{2}{3}$$

$$\ln c = 2$$

$$c = e^2$$

Question 31 (a)

Criteria	Marks
• Provides correct solution	2
• Equates the two expressions for the gradients, or equivalent merit	1

Sample answer:

gradient XP = gradient PY

$$\frac{0-2}{x-1} = \frac{y-2}{0-1}$$

$$(x-1)(y-2) = 2$$

$$y-2 = \frac{2}{x-1}$$

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

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

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

Question 31 (b)

Criteria	Marks
• Provides correct solution	4
• Solves $\frac{dA}{dx} = 0$ and determines the nature of stationary point at $x = 2$	3
• Finds $\frac{dA}{dx}$, or equivalent merit	2
• Attempts to find the area in terms of x	1

Sample answer:

$$A = \frac{x^2}{x-1} \qquad \left[\text{from } A = \frac{1}{2}xy \text{ and } y = \frac{2x}{x-1}\right]$$

$$\frac{dA}{dx} = \frac{(x-1)2x - x^2(1)}{(x-1)^2}$$

$$= \frac{2x^2 - 2x - x^2}{(x-1)^2}$$

$$= \frac{x^2 - 2x}{(x-1)^2}$$

$$= \frac{x(x-2)}{(x-1)^2}$$

$\frac{dA}{dx} = 0$ when $x = 0$ or $x = 2$

discard $x = 0$ since $x > 1$. (from question)

x	1.5	2	3
$\frac{dA}{dx}$	-3	0	$\frac{3}{4}$

Slope changes from negative to positive so

$x = 2$ is a minimum.

$$A = \frac{4}{2-1}$$

$\therefore$ Minimum area = 4 units^2

Question 32 (a)

Criteria	Marks
• Provides correct solution	2
• Uses the sum for a geometric progression	1

Sample answer:

$A_{180} = 0$

$$\therefore\ 200\,000(1.0025)^{180} = M\left[1 + (1.0025)^1 + \cdots + (1.0025)^{179}\right]$$

$$200\,000(1.0025)^{180} = M\left[\frac{(1.0025)^{180} - 1}{1.0025 - 1}\right]$$

$$M = \frac{200\,000(1.0025)^{180} \times 0.0025}{(1.0025)^{180} - 1}$$

$$= 1381.163281$$

$$= 1381.16 \text{ when rounded down}$$

Question 32 (b)

Criteria	Marks
• Provides correct solution	3
• Writes the equation in simplest exponential form	2
• Writes the equation in terms of *n* using the new interest rate and the new principal	1

Sample answer:

$$100\,032(1.0035)^n = 1381.16\left[\frac{(1.0035)^n - 1}{1.0035 - 1}\right]$$

$$100\,032 \times 0.0035(1.0035)^n = 1381.16(1.0035)^n - 1381.16$$

$$1031.048(1.0035)^n = 1381.16$$

$$(1.0035)^n = 1.33956906$$

$$n = \frac{\log(1.33956906)}{\log(1.0035)}$$

$$= 83.67407889$$

$$\therefore\ 83 \text{ full payments}$$

Question 32 (c)

Criteria	Marks
• Provides correct solution	2
• Substitutes $n = 83$ into amount owing, or equivalent merit	1

Sample answer:

After 83 payments

$$\begin{aligned}\text{Amount owing} &= 100\,032(1.0035)^{83} - 1381.16\left[\frac{(1.0035)^{83} - 1}{1.0035 - 1}\right] \\ &= 928.29\end{aligned}$$

$$\begin{aligned}\text{Final payment (84th month)} &= 928.29 \times 1.0035 \text{ (1-month interest)} \\ &= 931.54\end{aligned}$$

2022 HSC Mathematics Advanced Mapping Grid

Section I

Question	Marks	Content	Syllabus outcomes
1	1	MA-F1 Working with Functions	MA11-1
2	1	MA-S2 Descriptive Statistics and Bivariate Data Analysis	MA12-8
3	1	MA-T1 Trigonometry and Measure of Angles	MA11-3
4	1	MA-F1 Working with Functions	MA11-1
5	1	MA-C1 Introduction to Differentiation	MA11-5
6	1	MA-C4 Integral Calculus	MA12-7
7	1	MA-S3 Random Variables	MA12-8
8	1	MA-C4 Integral Calculus	MA12-7
9	1	MA-S1 Probability and Discrete Probability Distributions	MA11-7
10	1	MA-F2 Graphing Techniques	MA12-1

Section II

Question	Marks	Content	Syllabus outcomes
11 (a)	2	MA-S2 Descriptive Statistics and Bivariate Data Analysis	MA12-8
11 (b)	1	MA-S2 Descriptive Statistics and Bivariate Data Analysis	MA12-8
12 (a)	2	MA-F1 Working with Functions	MA11-1
12 (b)	2	MA-F1 Working with Functions	MA11-2
13	2	MA-C4 Integral Calculus	MA12-7
14	2	MA-T3 Trigonometric Functions and Graphs	MA12-5
15 (a)	1	MA-S1 Probability and Discrete Probability Distributions	MA11-7
15 (b)	1	MA-S1 Probability and Discrete Probability Distributions	MA11-7
16	3	MA-C4 Integral Calculus	MA12-7
17 (a)	2	MA-M1 Modelling Financial Situations	MA12-4
17 (b)	3	MA-M1 Modelling Financial Situations	MA12-4
18 (a)	2	MA-C2 Differential Calculus	MA12-6
18 (b)	1	MA-C4 Integral Calculus	MA12-7
19	3	MA-F2 Graphing Techniques	MA12-1

Question	Marks	Content	Syllabus outcomes
20 (a)	1	MA-E1 Logarithms and Exponentials	MA11-6
20 (b)	1	MA-E1 Logarithms and Exponentials	MA11-6
20 (c)	2	MA-C3 Applications of Differentiation	MA12-6
21 (a)	2	MA-M1 Modelling Financial Situations	MA12-2
21 (b)	2	MA-M1 Modelling Financial Situations	MA12-2
22	4	MA-C3 Applications of Differentiation	MA12-6
23 (a)	2	MA-T3 Trigonometric Functions and Graphs	MA12-5
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27 (a)	2	MA-C2 Differential Calculus	MA12-6
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28 (a)	2	MA-T1 Trigonometry and Measure of Angles	MA11-3
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30 (a)	1	MA-S3 Random Variables	MA12-8
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31 (a)	2	MA-F1 Working with Functions	MA11-1
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32 (a)	2	MA-M1 Modelling Financial Situations	MA12-4
32 (b)	3	MA-M1 Modelling Financial Situations	MA12-4
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