

ERRATA

Mathematics: Analysis and Approaches HL

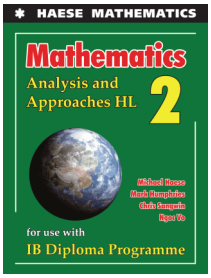
First edition - 2024 sixth reprint

The following erratum was made on 31/Jul/2026

page 819 **ANSWERS EXERCISE 5H**, questions **9 b** and **c**, should read:

9 **a** $x^2 - 2x + (1 + k^2)$ **b** $k = \pm 1, \pm 2, \pm 3$

c $pq = -1, -2, -5$ **d** $1, -2, 1 \pm 2i$



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First edition - 2024 fifth reprint

The following erratum was made on 21/Nov/2025

page 656 **CHAPTER 24 SECTION A**, second paragraph, should read:

However, if we only consider the terms up to x^n of the Maclaurin series expansion, we are left with an nth order polynomial approximation for the function.

The following erratum was made on 12/Sep/2025

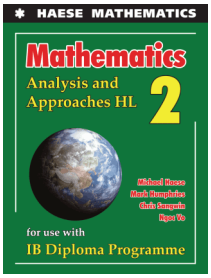
page 888 **ANSWERS REVIEW SET 22B**, question **17a**, should read:

17 **a** $(6\ln 3 - 4)$ units^2 **b** $\left(3\sqrt[3]{4} - \frac{3}{4}\right)$ units^2

The following erratum was made on 24/Jul/2025

page 871 **ANSWERS EXERCISE 18H**, question **3**, replace with:

3 Repeated use of l'Hôpital's rule does not help as the expression in the limit becomes more and more complicated.



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Mathematics: Analysis and Approaches HL

First edition - 2023 fourth reprint

The following errata were made on 05/Sep/2024

page 437 **CHAPTER 17 INVESTIGATION 1**, question **1**, should read:

What to do:

1 Use the binomial expansion $(x+h)^n = \sum_{r=0}^{n} \binom{n}{r} x^{n-r}h^r$

$= \binom{n}{0}x^n + \binom{n}{1}x^{n-1}h + \binom{n}{2}x^{n-2}h^2 + ... + \binom{n}{n}h^n$

and the first principles formula $f'(x) = \lim_{h\to 0} \dfrac{f(x+h)-f(x)}{h}$ to find the derivative of $f(x) = x^n$ for $n \in \mathbb{N}$.

page 654 **CHAPTER 24 OPENING PROBLEM**, question **e**, should read:

e Can we write an *exact* expression for e^x in the form $e^x = \sum_{k=0}^{\infty} c_k x^k$ where $c_k \in \mathbb{R}$?

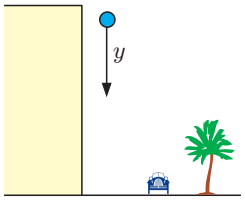
page 654 **CHAPTER 24 HISTORICAL NOTE**, third paragraph, should read:

In the 14th century, the Indian mathematician **Mādhava of Sangamagrāma** discovered infinite series expansions for a number of trigonometric functions, as well as infinite series for calculating π such as $\dfrac{\pi}{4} = \sum_{k=0}^{\infty} \dfrac{(-1)^k}{2k+1}$.

page 674 **CHAPTER 24 SECTION A**, example diagram for Object on a spring, should read:

For example:

A falling object



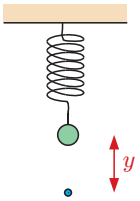
$\dfrac{d^2y}{dt^2} = 9.8$

A parachutist



$m\dfrac{dv}{dt} = mg - av^2$

Object on a spring



$m\dfrac{d^2y}{dt^2} = -ky$

page 700 **CHAPTER 25 ACTIVITY 1**, replace paragraphs 4 and 5 with:

In the case of a mass on a spring, k is determined by the mass of the object, and the stiffness of the spring.

In the case of a pendulum, k is determined by the weight on its end, and the length of the pendulum.

page 763 **CHAPTER 27 SECTION H**, blue box 3rd dot point, should read:

- The **standard deviation** of X is $\sigma = \sqrt{\text{Var}(X)} = \sqrt{np(1-p)}$.

The following erratum was made on 04/Jul/2024

page 250 **CHAPTER 10 ACTIVITY**, 7th line, should read:

Infinite descent was a historical precursor to mathematical induction. However, it is in fact a special form of proof by contradiction.

The following errata were made on 13/Mar/2024

page 133 **EXERCISE 5I**, question **9**, should read:

9 $f(x)$ is a polynomial of degree n with leading coefficient 1. The sum of its zeros is 5, and the product of its zeros is -3. Suppose $g(x) = [f(x)]^2$. Find:

a the degree of $g(x)$ **b** the sum of the zeros of $g(x)$

c the product of the zeros of $g(x)$ **d** the y-intercept of $y = g(x)$.

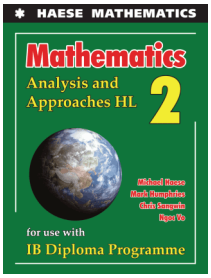
page 216 **EXERCISE 9B**, question **8**, should read:

8 Consider a 3-digit number "abc", $a \neq c$. Written backwards, it is "cba". Let S be the 3-digit result when the smaller of the two numbers is subtracted from the larger. When S is written backwards and the result is added to S, prove that the sum is always 1089.
For example: 276 backwards is 672, so $S = 396$ and $396 + 693 = 1089$.

The following erratum was made on 23/Oct/2023

page 530 **EXERCISE 19B**, question **20**, should read:

20 A cone has radius r cm and fixed slant height s cm.
Find the ratio of $s : r$ which maximises the volume of a cone.



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First edition - 2021 third reprint

The following erratum was made on 17/Apr/2023

page 821 **ANSWERS EXERCISE 5M**, question **4 f**, should read:

4 **a** $-2.09 < x < 0.572$ or $x > 2.51$
b $x < -1.66$ or $0.327 < x < 1.84$
c $-2.55 < x < 0.290$ or $x \geqslant 2.26$ **d** $x \leqslant \frac{3}{2}$
e $-1.20 < x < -0.125$ or $x > 1.33$ **f** $x < 0.924$

The following erratum was made on 15/Mar/2023

page 433 **REVIEW SET 16A**, question **9**, should read:

9 Let $f(x) = \begin{cases} 11 - 2x, & x \geqslant 3 \\ x + 2, & x < 3 \end{cases}$.

a Sketch the function $y = f(x)$. **b** Is f differentiable at $x = 3$?

The following errata were made on 06/Dec/2022

page 116 **EXERCISE 5C**, question **8 b**, should read:

8 The graph of the polynomial $P(x)$ has three x-intercepts, α, β, and γ.

a State the values of $P(\alpha)$, $P(\beta)$, and $P(\gamma)$.

b Explain why $P(x)$ cannot have a real linear factor $(x - a)$ such that $a \neq \alpha$, β, or γ.

page 817 **ANSWERS EXERCISE 5C**, question **8 b**, should read:

8 **a** $P(\alpha) = 0$, $P(\beta) = 0$, $P(\gamma) = 0$

b If $P(x)$ has a real linear factor of $(x - a)$, then $P(a) = 0$ which implies that $P(x)$ has x-intercept a which is distinct from the x-intercepts of α, β, and γ.
But $P(x)$ has only three x-intercepts and since $a \neq \alpha$, β, or γ, a cannot be one of them.
$\therefore$ $P(x)$ cannot have a factor of $(x - a)$.

The following erratum was made on 10/May/2022

page 386 **CHAPTER 14 HISTORICAL NOTE**, second paragraph should read:

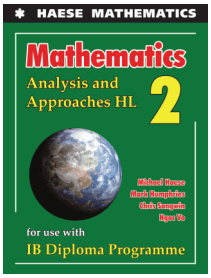
HISTORICAL NOTE EULER'S BEAUTIFUL EQUATION

One of the most remarkable results in mathematics is known as **Euler's beautiful equation** $e^{i\pi} = -1$ named after **Leonhard Euler**.

It is called beautiful because it links together three great constants of mathematics: Euler's number e, the imaginary number i, and the ratio of a circle's circumference to its diameter π.

Harvard lecturer **Benjamin Pierce** said of $e^{i\pi} = -1$,

> "Gentlemen, that is surely true, it is absolutely paradoxical; we cannot understand it, and we don't know what it means, but we have proved it, and therefore we know it must be the truth."



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Mathematics: Analysis and Approaches HL

First edition - 2020 second reprint

The following erratum was made on 12/Nov/2020

page 667 **CHAPTER 24 EXAMPLE 6**, solution to part **c** should read:

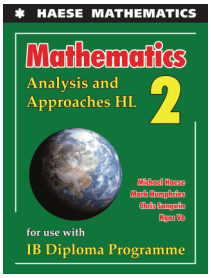
c $\arccos x \approx \frac{\pi}{2} - x - \frac{1}{6}x^3$ {using the first 3 terms}

$\therefore \arccos(x^2) \approx \frac{\pi}{2} - x^2 - \frac{1}{6}x^6$ for $|x| < 1$

$$\therefore \int_0^{0.4} \arccos\left(x^2\right) dx \approx \int_0^{0.4} \left(\frac{\pi}{2} - x^2 - \frac{x^6}{6}\right) dx \quad \text{since } |0.4| < 1$$

$$\approx \left[\frac{\pi}{2}x - \frac{x^3}{3} - \frac{x^7}{42}\right]_0^{0.4}$$

$$\approx 0.607$$



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Mathematics: Analysis and Approaches HL

First edition - 2019 first reprint

The following erratum was made on 12/Nov/2020

page 810 **ANSWERS REVIEW SET 2B**, question **9 b**, should read:

9 **a** $f(x)$: y-intercept 2, $g(x)$: y-intercept -1

b $\frac{5}{2} - \frac{1}{2}\sqrt{5}$ units

The following erratum was made on 27/Jul/2020

page 906 **ANSWERS EXERCISE 28C.1**, question **2 c**, should read:

2 **c** The times may be affected by:

- weather conditions
- walking speed
- physical fitness
- traffic.

The following errata were made on 17/Jun/2020

page 61 **CHAPTER 2 INVESTIGATION 2**, question **5**, should read:

5 For continuous growth, $u_n = u_0 e^{rt}$ where u_0 is the initial amount, r is the annual percentage rate, and t is the number of years.

Use this formula to find the final amount if \$1000 is invested for 1 year at a fixed rate of 6% per annum, where the interest is paid continuously.

page 661 **CHAPTER 24 SECTION B**, last line of summary table, should read:

SUMMARY OF IMPORTANT MACLAURIN SERIES

Function	*Maclaurin series*	*Interval of convergence*
e^x	$1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \ldots.$	$x \in \mathbb{R}$
$\sin x$	$x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \ldots.$	$x \in \mathbb{R}$
$\cos x$	$1 - \frac{x^2}{2!} + \frac{x^4}{4!} - \frac{x^6}{6!} + \ldots.$	$x \in \mathbb{R}$
$\arctan x$	$x - \frac{x^3}{3} + \frac{x^5}{5} - \frac{x^7}{7} + \ldots.$	$\lvert x \rvert \leqslant 1$
$\ln(1+x)$	$x - \frac{x^2}{2} + \frac{x^3}{3} - \frac{x^4}{4} + \ldots.$	$-1 < x \leqslant 1$
$(1+x)^p,\ \ p \in \mathbb{R}$	$1 + \sum_{k=1}^{\infty} \frac{p(p-1)\ldots.(p-k+1)}{k!} x^k$	$\lvert x \rvert < 1$

page 700 **EXERCISE 25H**, question **4**, should read:

4 Let $y(x) = 1 + \sum_{n=1}^{\infty} \frac{p(p-1)\ldots.(p-n+1)x^n}{n!}$ for $\lvert x \rvert < 1$. You may assume the series is convergent on this interval.

page 895 **ANSWERS EXERCISE 25D**, question **5 f**, should read:

5 **a** $y = \sqrt[3]{\frac{9}{2}x^2 + 1}$ **b** $y = \frac{1}{36}(x - 26)^2$

c $y = e^{x + \frac{1}{3}x^3}$ **d** $y = \arcsin\left(\frac{3}{2}x^2 - \frac{3}{2}\right)$

e $y = \left(\frac{9}{2}\sin 2x + 3\sqrt{3}\right)^{\frac{2}{3}}$

f $y = \ln\left[\sqrt[4]{|\,2x^2 + 4x + 1\,|}\left(e^2 + 3\right) - 3\right]$

The following errata were made on 04/Jun/2020

page 778 **EXERCISE 28B**, question **15 b**, should read:

15 **b** Suppose we wish to find the distribution of the random variable $Y = g(X)$ where g is an increasing and invertible function.

i Show that $F_Y(y) = F_X(g^{-1}(y))$.

ii Show that $f_Y(y) = f_X(g^{-1}(y)) \times \frac{d}{dy}g^{-1}(y)$.

page 894 **ANSWERS REVIEW SET 24B**, question **2 a**, was altered in error. It should read as originally printed:

2 **a**

n	2	4	6
$M_n(0.1)$	-0.2506	-0.2506	-0.2506
$M_n(1)$	-0.3125	-0.3281	-0.3320
$M_n(2)$	-0.5	-0.75	-1

page 907 **ANSWERS EXERCISE 28D.1**, question **10 b**, was altered in error. It should read as originally printed:

10 **a** $\approx 84.1\%$ **b** ≈ 0.880

The following errata were made on 13/May/2020

page 583 **EXERCISE 21F**, question **21**, should read:

21 Find $\int \frac{1}{ax^2 + bx + c}\,dx, \quad a \neq 0.$

Hint: You will need to consider the cases $b^2 < 4ac$, $b^2 > 4ac$, and $b^2 = 4ac$ separately.

page 865 **ANSWERS EXERCISE 18C**, question **4 c**, should read:

4 **a** increasing for $x \geqslant 0$, decreasing for $x \leqslant 0$

b never increasing, decreasing for all $x \in \mathbb{R}$

c increasing for $x \geqslant 0$, never decreasing

d increasing for $x \geqslant -\frac{3}{4}$, decreasing for $x \leqslant -\frac{3}{4}$

page 873 **ANSWERS REVIEW SET 18C**, question **25 b**, should read:

25 **a** $0 \leqslant x \leqslant \frac{\pi}{2}$ and $\frac{3\pi}{2} \leqslant x \leqslant 2\pi$

b $f'(x) = -\frac{\sin x}{2\sqrt{\cos x}}$, increasing for $\frac{3\pi}{2} \leqslant x \leqslant 2\pi$,
decreasing for $0 \leqslant x \leqslant \frac{\pi}{2}$

page 880 **ANSWERS EXERCISE 21B**, question **6 b**, should read:

6 **a** $\frac{4^x}{\ln 4} + c$ **b** $3\ln|\,x\,| - \log_2|\,x\,| + c$

c $\frac{5^x}{\ln 5} - \frac{2 \times 7^x}{\ln 7} + c$ **d** $-\operatorname{cosec} x + c$

e $\sin x - \cot x + c$ **f** $-\frac{8}{3x\sqrt{x}} - \frac{1}{9}\sec x + c$

The following errata were made on 11/May/2020

page 72 **EXERCISE 3B**, question **6**, should read:

6 Suppose $\log_a b = x$, $x \neq 0$. Find, in terms of x, the value of $\log_b a$.

page 582 **CHAPTER 21 EXAMPLE 17**, question should read:

Example 17 **Self Tutor**

Find $\int \frac{\sqrt{x^2-9}}{x}\,dx$, where $x \geqslant 3$.

Let $x = 3\sec\theta$ $\quad\therefore\quad \frac{dx}{d\theta} = 3\sec\theta\tan\theta$

page 582 **EXERCISE 21F**, questions **17 b**, **18 f**, and **18 l**, should read:

17 Find:

a $\int \frac{1}{36+4x^2}\,dx$ using $x = 3\tan\theta$ **b** $\int \frac{\sqrt{4x^2-1}}{5x}\,dx$, $x \geqslant \frac{1}{2}$ using $x = \frac{1}{2}\sec\theta$.

18 Integrate with respect to x:

a $\frac{x^2}{9+x^2}$ **b** $\frac{x^2}{\sqrt{1-x^2}}$ **c** $\sqrt{9-x^2}$ **d** $\frac{4\ln x}{x(1+[\ln x]^2)}$

e $x^2\sqrt{1-x^2}$ **f** $\frac{\sqrt{x^2-4}}{x}$, $x \geqslant 2$ **g** $\frac{1}{\sqrt{9-4x^2}}$ **h** $\frac{1}{x(9+4[\ln x]^2)}$

i $\frac{1-2x}{\sqrt{4-x^2}}$ **j** $\frac{x+4}{x^2+4}$ **k** $\frac{1}{x(x^2+16)}$ **l** $\frac{3}{x\sqrt{x^2-4}}$, $x > 2$

m $\frac{1}{x^2\sqrt{16-x^2}}$ **n** $\frac{1}{x^2+2x+3}$ **o** $\frac{1}{x(1+x^2)}$ **p** $x^2\sqrt{4-x^2}$

page 667 **CHAPTER 24 EXAMPLE 6**, solution to part **b** should read:

b $\arccos x - \arccos(0) = \int_0^x \frac{-1}{\sqrt{1-t^2}}\,dt$

$$\therefore\quad \arccos x - \tfrac{\pi}{2} = -\int_0^x \left(1 + \sum_{k=1}^{\infty} \frac{(2k)!}{4^k(k!)^2}\,t^{2k}\right) dt$$

$$= -\left(\int_0^x 1\,dt + \sum_{k=1}^{\infty} \frac{(2k)!}{4^k(k!)^2}\int_0^x t^{2k}\,dt\right)$$

$$= -\left(\left[t\right]_0^x + \sum_{k=1}^{\infty} \frac{(2k)!}{4^k(k!)^2}\left[\frac{t^{2k+1}}{2k+1}\right]_0^x\right)$$

$$= -\left(x + \sum_{k=1}^{\infty} \frac{(2k)!}{4^k(k!)^2(2k+1)}\,x^{2k+1}\right)$$

$$\therefore\quad \arccos x = \tfrac{\pi}{2} - x - \sum_{k=1}^{\infty} \frac{(2k)!}{4^k(k!)^2(2k+1)}\,x^{2k+1}$$

This is valid provided $|x| < 1$. This covers the domain of $\arccos x$ except its endpoints ± 1.

page 814 **ANSWERS EXERCISE 3H**, question **10 a**, should read:

10 **a** $\frac{x}{e}$, Domain is $\{x \mid x > 0\}$, Range is $\{y \mid y > 0\}$

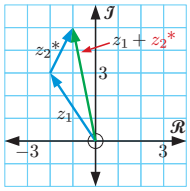
page 835 **ANSWERS EXERCISE 10A**, question **3 a**, should read:

3 **a** $2 + 4 + 6 + 8 + 10 + ... + 2n = n(n + 1)$,

$\sum_{i=1}^{n} 2i = n(n + 1)$ for all $n \in \mathbb{Z}^+$.

page 850 **ANSWERS EXERCISE 14A**, question **6 a**, should read:

6 **a** $-1 + 5i$



page 853 **ANSWERS REVIEW SET 14A**, question **5 c**, should read:

5 **a** A reflection in the $\mathcal{R}$-axis, followed by a stretch with scale factor 2.

b A rotation of π about O, followed by a stretch with scale factor $\frac{1}{2}$.

c A reflection in the $\mathcal{R}$-axis, followed by an anticlockwise rotation of $\frac{\pi}{2}$ about O.

page 854 **ANSWERS EXERCISE 15A**, question **7**, replace with:

7 $\lim_{x \to a} f(x) = l \Leftrightarrow \lim_{x \to a} f(x) = \lim_{x \to a} l$

$\Leftrightarrow \lim_{x \to a} f(x) - \lim_{x \to a} l = 0$

$\Leftrightarrow \lim_{x \to a} (f(x) - l) = 0$

page 872 **ANSWERS REVIEW SET 18A**, question **24 c**, should read:

24 **a** concave up for $x \geqslant \frac{4}{3}$, concave down for $x \leqslant \frac{4}{3}$

b concave up for $x \leqslant -3$,
concave down for $-3 \leqslant x < 0$ and $x > 0$

c concave up for $-4 < x \leqslant -2$ and $x > 0$,
concave down for $x < -4$ and $-2 \leqslant x < 0$

page 881 **ANSWERS EXERCISE 21B**, question **11 d**, should read:

11 **d** $f(x) = 2x + 3 \arctan x + c$

The following errata were made on 27/Apr/2020

page 38 **CHAPTER 1 ACTIVITY 3**, question **4** should read:

4 Predict the graph of $f(x) = \sum_{k=1}^{\infty} \frac{\sin[(2k-1)x]}{2k-1}$.

page 117 **EXERCISE 5C**, questions **13 c** and **14 c**, should read:

13 **a** Suppose a quadratic function with *rational* coefficients has the *irrational* zero $p + q\sqrt{n}$. Prove that the other zero must be the radical conjugate $p - q\sqrt{n}$.

b $1 - \sqrt{2}$ is a zero of $x^2 + ax + b$ where $a, b \in \mathbb{Q}$. Find a and b.

c Find all real quadratic functions with rational coefficients such that one zero is $2 + \sqrt{5}$.

14 **a** Prove that if a *real* quadratic function has one zero $p + qi$, then the other zero must be the complex conjugate $p - qi$.

b $3 + i$ is a zero of $x^2 + ax + b$ where $a, b \in \mathbb{R}$. Find a and b.

c Find all real quadratic functions such that one zero is $\sqrt{2} + i$.

d $a + ai$ is a zero of $x^2 + 4x + b$ where $a, b \in \mathbb{R}$. Find a and b.

page 150 **REVIEW SET 5B**, question **28 a**, replace with:

28 Find all zeros of:

a $3z^3 - z^2 + 21z - 7$ **b** $x^3 + 6x^2 - 9x - 14$

page 186 **EXERCISE 7E**, question **7**, should read:

7 A Mahjong set contains:

- 4 of each of 9 tiles, in each of 3 suits
- 4 of each of 3 dragons
- 1 of each of 4 seasons.
- 4 of each of 4 winds
- 1 of each of 4 flowers

Explain why the total number of ways in which the tiles can be ordered is $\frac{144!}{(4!)^{34}}$.

page 231 **REVIEW SET 9A**, question **10 a**, should read:

10 **a** Prove that the fifth powers of the numbers $k = 0, 1, 2, 3, ..., 9$ all have last digit k.

b Hence prove that n always has the same last digit as its 5th power n^5, for all $n \in \mathbb{Z}$.
Hint: Consider writing an integer in the form $10m + k$.

page 238 **CHAPTER 10 EXAMPLE 3**, solution to part **a**, third line should read:

a If $n = 0$, $4^n + 2 = 4^0 + 2 = 3$ which is divisible by 3.

$4^n + 2 = (1 + 3)^n + 2$

$= \binom{n}{0} 3^0 + \binom{n}{1} 3^1 + \binom{n}{2} 3^2 + \binom{n}{3} 3^3 + ... + \binom{n}{n-1} 3^{n-1} + \binom{n}{n} 3^n + 2$

$= 3 + \binom{n}{1} 3 + \binom{n}{2} 3^2 + \binom{n}{3} 3^3 + ... + \binom{n}{n-1} 3^{n-1} + \binom{n}{n} 3^n$

page 259 **CHAPTER 11 SECTION C**, third paragraph should note:

When we perform this process we may obtain one of the forms below, with corresponding numbers of solutions:

$\left(\begin{array}{cc|c} 1 & \square & \square \\ 0 & 1 & \square \end{array}\right)$ $\left(\begin{array}{cc|c} 1 & \square & \square \\ 0 & 0 & \square \end{array}\right)$ ← not zero $\left(\begin{array}{cc|c} 1 & \square & \square \\ 0 & 0 & 0 \end{array}\right)$

1 solution no solutions infinitely many solutions

page 262 **CHAPTER 11 EXAMPLE 4**, fifth line should read:

$$\sim \left(\begin{array}{ccc|c} 1 & 3 & -1 & 15 \\ 0 & 1 & -\frac{3}{5} & \frac{23}{5} \\ 0 & 0 & 1 & -1 \end{array}\right) \qquad \begin{array}{l} -\frac{1}{5}R_2 \to R_2 \\ -\frac{1}{17}R_3 \to R_3 \end{array}$$

Using row 3, $z = -1$

page 265 **EXERCISE 11D**, question **8**, first line should read:

8 Consider the system $\begin{cases} x + 4y + mz = -m \\ (m+1)x + 4y + z = 1 \\ 4x + 4y + z = 1 \end{cases}$ where $m \in \mathbb{R}$, $m \neq 0$.

page 304 **CHAPTER 12 EXAMPLE 30**, should read:

Example 30 **Self Tutor**

Find two vectors of length 3 units which are perpendicular to $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$.

$\begin{pmatrix} -1 \\ 4 \end{pmatrix} \bullet \begin{pmatrix} 4 \\ 1 \end{pmatrix} = -4 + 4 = 0$

$\therefore$ vectors of the form $k\begin{pmatrix} 4 \\ 1 \end{pmatrix}$, $k \neq 0$ are perpendicular to $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$.

Now $\begin{pmatrix} 4 \\ 1 \end{pmatrix}$ has length $\sqrt{16+1} = \sqrt{17}$ units

$\therefore \ |k|\sqrt{17} = 3$

$\therefore \ |k| = \frac{3}{\sqrt{17}}$

$\therefore \ k = \pm\frac{3}{\sqrt{17}}$

$\therefore$ the vectors of length 3 units which are perpendicular to $\begin{pmatrix} -1 \\ 4 \end{pmatrix}$ are $\pm\frac{3}{\sqrt{17}}\begin{pmatrix} 4 \\ 1 \end{pmatrix}$, which are $\begin{pmatrix} \frac{12}{\sqrt{17}} \\ \frac{3}{\sqrt{17}} \end{pmatrix}$ and $\begin{pmatrix} -\frac{12}{\sqrt{17}} \\ -\frac{3}{\sqrt{17}} \end{pmatrix}$.

page 304 **EXERCISE 12L**, question **8**, first line should read:

8 Find two vectors of length:

page 308 **EXERCISE 12M**, question **4**, first line should read:

4 ABCD is a quadrilateral in which P bisects both [AC] and [BD].

page 339 **EXERCISE 13F EXAMPLE 11**, question **4**, third and fourth lines of solution should read:

$$\sim \left(\begin{array}{cc|c} 3 & 5 & 9 \\ 0 & 19 & 57 \end{array}\right) \quad 2R_1 - 3R_2 \to R_2 \quad \left\{\begin{array}{ccc} 6 & 10 & 18 \\ -6 & 9 & 39 \\ \hline 0 & 19 & 57 \end{array}\right\}$$

$$\sim \left(\begin{array}{cc|c} 1 & \frac{5}{3} & 3 \\ 0 & 1 & 3 \end{array}\right) \quad \begin{array}{l} \frac{1}{3}R_1 \to R_1 \\ \frac{1}{19}R_2 \to R_2 \end{array}$$

page 409 **CHAPTER 15 INVESTIGATION**, questions **2 c i** and **ii** become **2 b i** and **ii**, question **2 d** becomes **2 c**.

page 508 **REVIEW SET 18A**, question **4** was a duplicate of Review Set 17A Question 8, change to:

4 Find all points on the curve $y = 4x^3 + 6x^2 - 13x + 1$ where the gradient of the tangent is 11.

page 511 **REVIEW SET 18A**, question **32 d**, should read:

32 Consider the function $f(x) = xe^{-x^2}$.

a Find $f'(x)$ and $f''(x)$.

b Find and classify the turning points of $y = f(x)$.

c Use l'Hôpital's rule to consider the behaviour of $f(x)$ as $x \to \pm\infty$.

d Find the inflection points of $y = f(x)$.

e Sketch $y = f(x)$, showing the features you have found.

page 607 **CHAPTER 22 ACTIVITY 1**, question **2 a** change to match example diagram:

2 Consider the total area enclosed between $y = -x^3 + x^2 + 6x$ and $y = 2x + 4$ on the interval $-2 \leqslant x \leqslant 2$.

a Explain why the total area is equal to $\displaystyle\int_{-2}^{2} \left|\, (-x^3 + x^2 + 6x) - (2x + 4) \,\right| dx$

$$= \int_{-2}^{2} \left|\, -x^3 + x^2 + 4x - 4 \,\right| dx$$

page 657 **EXERCISE 24A**, question **7**, replace with new questions **7** and **8**:

7 Show that the Maclaurin series representation for $\ln\left(\frac{1+x}{1-x}\right)$ is $\displaystyle\sum_{k=1}^{\infty} \frac{2}{2k-1} x^{2k-1}$.

8 **a** Prove by mathematical induction that

$$\frac{d^n}{dx^n}(\arctan x) = \frac{i(-1)^{n-1}(n-1)!}{2}\left(\frac{1}{(x+i)^n} - \frac{1}{(x-i)^n}\right) \quad \text{for all } n \in \mathbb{Z}^+.$$

b Hence show that the Maclaurin series representation for $\arctan x$ is $\displaystyle\sum_{k=1}^{\infty} \frac{(-1)^{k-1}}{2k-1} x^{2k-1}$.

page 689 **EXERCISE 25D**, question **20**, should read:

20 Since water and oil are *immiscible*, oil spilt in water will form a cylindrical patch on the surface of the water. The radius of the patch increases at a rate proportional to the thickness of the patch, which is the height of the cylinder.

page 760 **CHAPTER 27 INVESTIGATION 2**, question **1**, change for simplicity:

What to do:

1 Click on the icon to access the demonstration. It shows the graph of the binomial distribution for $X \sim \text{B}(n, p)$. Set $n = 25$ and $p = 0.1$.

a What is the mode of X?

b Describe the shape of the distribution.

page 805 **ANSWERS REVIEW SET 1A**, question **11 c**, $x = 3$ is not a valid solution:

9 $x = 0,\ \frac{\pi}{4},\ \pi,\ \frac{5\pi}{4}$, or 2π **11** **c** $x = \frac{16}{3}$

page 809 **ANSWERS EXERCISE 2F**, question **18**, should read:

18 $e^1 \approx \sum_{k=0}^{19} \frac{1}{k!} 1^k \approx 2.718\,281\,828$

page 818 **ANSWERS EXERCISE 5D**, questions **2 b** and **4**, should read:

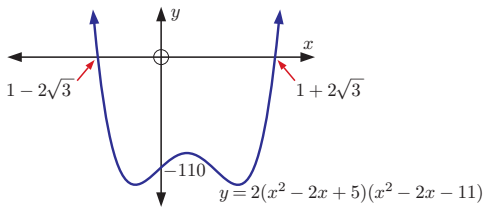
2 **a** $a = 2,\ b = -2$ or $a = -2,\ b = 2$
b $a = 2,\ b = -1$
c $a = 3,\ b = -1$

4 $a = -2,\ b = 2,\ x = -1 \pm \sqrt{3}$

page 821 **ANSWERS REVIEW SET 5A**, question **19 b**, should have diagram:

19 **a** $m = 1,\ n = \pm 2$

b



To make room for this diagram, the following questions have moved to subsequent pages:
ANSWERS REVIEW SET 5A questions **24 a** and **b** moved from page 821 to page 822,
ANSWERS REVIEW SET 5B questions **25** and **26** moved from page 822 to page 823,
ANSWERS EXERCISE 6C.1 question **3 a** moved from page 823 to page 824.

page 822 **ANSWERS REVIEW SET 5B**, question **3 b**, should read:

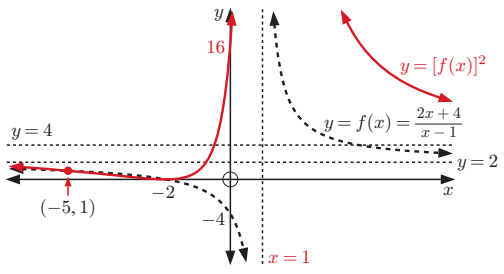
3 **a** $(3x - 2)$ and $(x - 3)$, zeros are $\frac{2}{3}$ and 3
b $(z - 1)$, $(2z + 1)$, and $(z^2 - 2z + 6)$,
zeros are $1,\ -\frac{1}{2},\ 1 \pm i\sqrt{5}$

page 823 **ANSWERS REVIEW SET 5B**, question **28 a**, should read:

28 **a** $\frac{1}{3}$ and $\pm i\sqrt{7}$ **b** $-7,\ -1$, and 2

page 823 **ANSWERS EXERCISE 6B**, question **7 d**, should include vertical asymptote label:

7 **d**



page 831 **ANSWERS EXERCISE 7E**, questions **8 b**, **27 b**, and **27 c**, should read:

8 **a** $\frac{1}{2}n^2 - \frac{1}{2}n,\ n \in \mathbb{Z}^+,\ n \geqslant 2$
b $\frac{1}{24}n^4 - \frac{1}{4}n^3 + \frac{11}{24}n^2 - \frac{1}{4}n,\ n \in \mathbb{Z}^+,\ n \geqslant 4$

27 **a** $\binom{52}{13} = 635\,013\,559\,600$
b $\binom{13}{4}\binom{39}{9} = 151\,519\,319\,380$ **c** $\dfrac{\binom{13}{4}\binom{39}{9}}{\binom{52}{13}} \approx 0.239$

page 832 **ANSWERS REVIEW SET 7B**, questions **11 a** and **12**, should read:

11 **a** 6435 **b** 2 627 625

12 4347

page 832 **ANSWERS EXERCISE 8A**, question **4 b**, should read:

4 **a** 1 5 10 10 5 1

b $(a+b)^5 = a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5ab^4 + b^5$

page 834 **ANSWERS EXERCISE 9C**, questions **6 a** and **7 a**, should read:

6 **a** $(a-b)(a+b) = b(a-b) \;\not\Rightarrow\; a+b=b$

$2a = a \;\not\Rightarrow\; 2=1$

b $\dfrac{4x-40}{6-x} = \dfrac{4x-40}{13-x} \;\not\Rightarrow\; 6-x = 13-x$

7 **a** $6x-12 = 3(x-2) \;\not\Rightarrow\; 6x-12+3(x-2)=0$

b $x(x-6) = 3(-3) \;\not\Rightarrow\; x=3 \;\vee\; x-6=-3$

page 834 **ANSWERS EXERCISE 9E**, question **5**, should read:

5 **Hint:** Let $n = 7k,\ 7k+1,\ ....,\ 7k+6$, and show that n^2+4 never leaves remainder 0 when divided by 7.

page 835 **ANSWERS REVIEW SET 9B**, question **4 b**, should read:

4 **a** not equivalent **b** not equivalent

page 837 **ANSWERS EXERCISE 11D**, questions **8 c** and **d**, should read:

8 **c** The system has infinitely many solutions if the last row is all zeros. This occurs when $m = 3$. The solutions have the form $x = \dfrac{4+2t}{3},\ y = \dfrac{-13-11t}{12},\ z = t$, where $t \in \mathbb{R}$.

d $x = 0,\ y = \dfrac{m}{2(m-1)},\ z = \dfrac{m+1}{1-m},\ m \in \mathbb{R},\ m \neq 1$ or 3

page 837 **ANSWERS REVIEW SET 11A**, question **3 b**, should read:

3 **a** $\left(\begin{array}{cc|c} 4 & -6 & -1 \\ a & 2 & 3 \end{array}\right)$ **b** $\sim \left(\begin{array}{cc|c} 4 & -6 & -1 \\ -3a & -6 & -9 \end{array}\right)$

page 838 **ANSWERS REVIEW SET 11B**, questions **1 b**, **5** and **8 c**, should read:

1 **a** consistent; $x = \frac{2}{3},\ y = 0$ is a solution

b inconsistent; $x+4y+z$ cannot be equal to both 1 and -1 simultaneously.

5

- If $a = -8,\ b = 20$, there are infinitely many solutions of the form $x = 5+2t,\ y = t$, where $t \in \mathbb{R}$.
- If $a = -8,\ b \neq 20$, there are no solutions.
- If $a \neq -8$, the system has the unique solution $x = 5+2\left(\dfrac{b-20}{a+8}\right),\ y = \dfrac{b-20}{a+8}$.

8 **a** $\sim \left(\begin{array}{ccc|c} 1 & 4 & -1 & k \\ 0 & 8 & -1 & 3+2k \\ 0 & 0 & k-3 & 3-k \end{array}\right)$

b infinitely many solutions when $k = 3$:

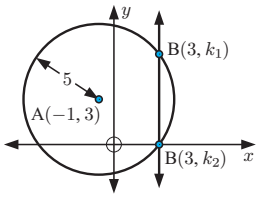
$x = \dfrac{t-3}{2},\ y = \dfrac{t+9}{8},\ z = t$, where $t \in \mathbb{R}$

c $x = -2,\ y = \dfrac{k+1}{4},\ z = -1,\ k \in \mathbb{R},\ k \neq 3$

page 841 **ANSWERS EXERCISE 12I**, question **14 c**, should read:

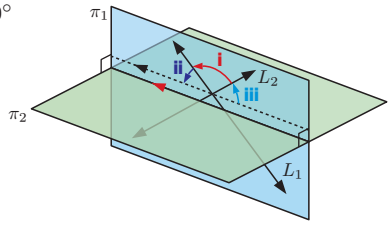
14 **a** $\overrightarrow{AB} = \begin{pmatrix} 4 \\ k-3 \end{pmatrix}$, $|\overrightarrow{AB}| = \sqrt{16 + (k-3)^2}$ units

b $k = 0$ or 6 **c**



page 847 **ANSWERS EXERCISE 13H**, question **7 e**, diagram should be:

7 **e** 180°



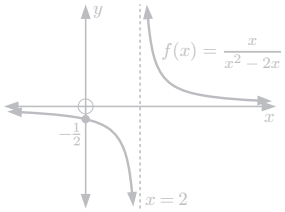
page 851 **ANSWERS EXERCISE 14D.3**, question **7 a**, should read:

7 **a** $|-z| = 3$, $\arg(-z) = \theta \pm \pi$

page 854 **ANSWERS EXERCISE 15B**, question **4 c iii**, should read:

4 **a** $x = 0$ or 2

b



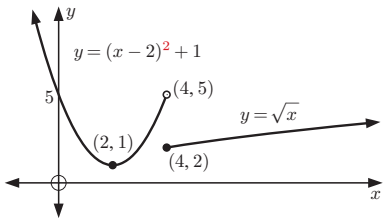
c **i** does not exist

ii -1

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

page 857 **ANSWERS REVIEW SET 15B**, question **7 a**, should have correct function label:

7 **a**



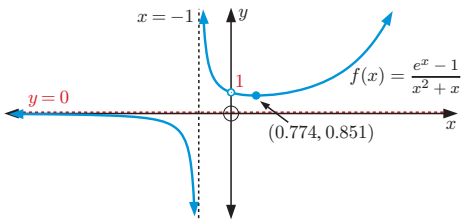
page 859 **ANSWERS EXERCISE 17A**, question **9**, should read:

9 $f'_-(2) = 14 \neq f'_+(2) = 16$

$\therefore$ not differentiable at $x = 2$.

page 871 **ANSWERS EXERCISE 18H**, questions **5 e** and **10**, should read:

5 **e**



10 **Hint:** Consider $\lim_{x \to \infty} \frac{\ln x}{x^k}$, $k > 0$.

page 879 **ANSWERS EXERCISE 21A**, question **7**, should read:

7 **a** $\dfrac{d}{dx}(3^x) = 3^x \ln 3$

$\therefore \int 3^x \ln 3 \, dx = 3^x + c$

$\therefore \int 3^x \, dx = \dfrac{3^x}{\ln 3} + c$

b $\dfrac{d}{dx}(a^x) = a^x \ln a$

$\therefore \int a^x \ln a \, dx = a^x + c$

$\therefore \int a^x \, dx = \dfrac{a^x}{\ln a} + c, \quad a > 0, \quad a \neq 1$

page 881 **ANSWERS EXERCISE 21D**, question **9 b iii**, should read:

9 **b** **i** $\dfrac{3^{2x-1}}{2\ln 3} + c$ **ii** $-\dfrac{5^{-x}}{\ln 5} + c$

iii $\dfrac{2^{5x}}{5\ln 2} + \dfrac{7^{1-2x}}{2\ln 7} + c$

page 883 **ANSWERS EXERCISE 21F**, question **21**, should read:

21 $\dfrac{2}{\sqrt{4ac-b^2}} \arctan\left(\dfrac{2ax+b}{\sqrt{4ac-b^2}}\right) + d$ if $b^2 < 4ac$,

$\dfrac{1}{\sqrt{b^2-4ac}} \ln\left|\dfrac{2ax+b-\sqrt{b^2-4ac}}{2ax+b+\sqrt{b^2-4ac}}\right| + d$ if $b^2 > 4ac$,

$-\dfrac{2}{2ax+b} + d$ if $b^2 = 4ac$.

page 883 **ANSWERS REVIEW SET 21A**, questions **16 f** and **17 b**, should read:

16 **a** $\frac{1}{2}\ln|x^2+4x| + c$ **b** $e^{x^2-1} + c$

c $\frac{1}{10}\sin^{10} x + c$ **d** $-\frac{1}{2}\ln|\cos 2x| + c$

e $e^{\sin x} + c$ **f** $\frac{1}{2}(\arcsin x)^2 + c$

17 **a** $-\frac{32}{3}(4-x)^{\frac{3}{2}} + \frac{16}{5}(4-x)^{\frac{5}{2}} - \frac{2}{7}(4-x)^{\frac{7}{2}} + c$

b $-x - 6\ln|2-x| - \dfrac{12}{2-x} + \dfrac{4}{(2-x)^2} + c$

c $\frac{2}{3}(x+2)^{\frac{3}{2}} - (x+2) - 2\sqrt{x+2} + 2\ln(\sqrt{x+2}+1) + c$

page 885 **ANSWERS EXERCISE 22C**, question **12 f**, should read:

12 **a** $\frac{1}{2}$ units^2 **b** $(e-1)$ units^2 **c** $4\frac{1}{2}$ units^2

d 18 units^2 **e** $\left(2e - \dfrac{2}{e}\right)$ units^2 **f** $\dfrac{3^{\ln 3} - 1}{\ln 3}$ units^2

g $\frac{\pi}{6}$ units^2 **h** $4\arctan\frac{1}{2}$ units^2

page 887 **ANSWERS EXERCISE 22I**, question **2 c**, should read:

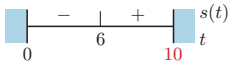
2 **a** $\frac{1}{4}$ units^2 **b** $\frac{\pi}{2}$ units^2 **c** $\dfrac{1}{\ln 3}$ units^2

page 888 **ANSWERS REVIEW SET 22B**, question **17 a**, should read:

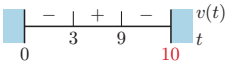
17 **a** $3(\ln 3 + \ln 2 - 1)$ units^2 **b** $\left(3\sqrt[3]{4} - \frac{3}{4}\right)$ units^2

page 888 **ANSWERS EXERCISE 23B.1**, question **3 e**, sign diagrams should terminate at $t = 10$:

3 **e** **i**



ii



page 889 **ANSWERS EXERCISE 23C**, questions **3 c** and **5 c**, should read:

3 **c** At $t = 5$ s, the stone is 367.5 m above the ground and moving upward at 49 m s^{-1}. It has acceleration -9.8 m s^{-2}.
At $t = 12$ s, the stone is 470.4 m above the ground and moving downward at 19.6 m s^{-1}. It has acceleration -9.8 m s^{-2}.

5 **c** **i** $t > \frac{1}{2}$ **ii** $0 \leqslant t < \frac{1}{2}$ **e** $\frac{4}{25}$ cm s^{-2}

page 893 **ANSWERS EXERCISE 24C**, question **5 b**, replace with:

5 **a** $\sin(x + \frac{\pi}{2}) = \sum_{k=0}^{\infty} \frac{(-1)^k (x + \frac{\pi}{2})^{2k+1}}{(2k+1)!}$

b
$$\begin{aligned}
&\sin(x + \tfrac{\pi}{2}) \\
&= (\tfrac{\pi}{2} + x) - \tfrac{1}{3!}(\tfrac{\pi}{2} + x)^3 + \tfrac{1}{5!}(\tfrac{\pi}{2} + x)^5 \\
&\quad - \tfrac{1}{7!}(\tfrac{\pi}{2} + x)^7 + \ldots. \\
&= \tfrac{\pi}{2} + x - \tfrac{1}{3!}\left((\tfrac{\pi}{2})^3 + 3(\tfrac{\pi}{2})^2 x + 3(\tfrac{\pi}{2})x^2 + x^3\right) \\
&\quad + \tfrac{1}{5!}\left((\tfrac{\pi}{2})^5 + 5(\tfrac{\pi}{2})^4 x + 10(\tfrac{\pi}{2})^3 x^2 + 10(\tfrac{\pi}{2})^2 x^3\right. \\
&\qquad \left. + 5(\tfrac{\pi}{2})x^4 + x^5\right) \\
&\quad - \tfrac{1}{7!}\left((\tfrac{\pi}{2})^7 + 7(\tfrac{\pi}{2})^6 x + 21(\tfrac{\pi}{2})^5 x^2 + 35(\tfrac{\pi}{2})^4 x^3\right. \\
&\qquad \left. + 35(\tfrac{\pi}{3})^3 x^4 + 21(\tfrac{\pi}{2})^2 x^5 + 7(\tfrac{\pi}{2})x^6 + x^7\right) \\
&\quad + \ldots. \\
&= \left(\tfrac{\pi}{2} - \tfrac{1}{3!}(\tfrac{\pi}{2})^3 + \tfrac{1}{5!}(\tfrac{\pi}{2})^5 - \tfrac{1}{7!}(\tfrac{\pi}{2})^7 + \ldots.\right) \\
&\quad + \left(1 - \tfrac{1}{2!}(\tfrac{\pi}{2})^2 + \tfrac{1}{4!}(\tfrac{\pi}{2})^4 - \tfrac{1}{6!}(\tfrac{\pi}{2})^6 + \ldots.\right)x \\
&\quad - \tfrac{1}{2!}\left(\tfrac{\pi}{2} - \tfrac{1}{3!}(\tfrac{\pi}{2})^3 + \tfrac{1}{5!}(\tfrac{\pi}{2})^5 - \ldots.\right)x^2 \\
&\quad - \tfrac{1}{3!}\left(1 - \tfrac{1}{2!}(\tfrac{\pi}{2})^2 + \tfrac{1}{4!}(\tfrac{\pi}{2})^4 - \ldots.\right)x^3 \\
&\quad + \tfrac{1}{4!}\left(\tfrac{\pi}{2} - \tfrac{1}{3!}(\tfrac{\pi}{2})^3 + \ldots.\right)x^4 + \ldots.
\end{aligned}$$

Now, $\frac{\pi}{2} - \frac{1}{3!}(\frac{\pi}{2})^3 + \frac{1}{5!}(\frac{\pi}{2})^5 - \frac{1}{7!}(\frac{\pi}{2})^7 + \ldots. = \sin\frac{\pi}{2} = 1$
and $1 - \frac{1}{2!}(\frac{\pi}{2})^2 + \frac{1}{4!}(\frac{\pi}{2})^4 - \frac{1}{6!}(\frac{\pi}{2})^6 + \ldots. = \cos\frac{\pi}{2} = 0$
$\therefore \quad \sin(x + \frac{\pi}{2}) = 1 - \frac{1}{2!}x^2 + \frac{1}{4!}x^4 - \ldots. = \cos x$
This result agrees with the identity $\sin(x + \frac{\pi}{2}) = \cos x$.

page 893 **ANSWERS EXERCISE 24F**, question **4**, should read:

4 **a** $e^{-x^3} = \sum_{k=0}^{\infty} \frac{(-1)^k x^{3k}}{k!} = 1 - x^3 + \frac{x^6}{2!} - \frac{x^9}{3!} + \ldots.$

b $e^{-x^3}\cos x = 1 - \frac{1}{2}x^2 - x^3 + \frac{1}{24}x^4 + \frac{1}{2}x^5 + \frac{359}{720}x^6 - \frac{1}{24}x^7 - \frac{10\,079}{40\,320}x^8 - \frac{119}{720}x^9 - \ldots.$

page 894 **ANSWERS EXERCISE 24G**, questions **3 a ii** and **7 b**, should read:

3 **a** **i** $e^{2x} - 1 = \sum_{k=1}^{\infty} \frac{2^k x^k}{k!} = 2x + 2x^2 + \frac{4}{3}x^3 + \ldots.$

ii $\sin 4x = \sum_{k=0}^{\infty} \frac{(-1)^k 4^{2k+1} x^{2k+1}}{(2k+1)!}$
$= 4x - \frac{32}{3}x^3 + \frac{128}{15}x^5 - \ldots.$

7 **a** $\sin x$ has zeros $n\pi$, $n \in \mathbb{Z}$.
$\frac{\sin x}{x}$ has zeros $n\pi$, $n \in \mathbb{Z}$, $n \neq 0$.

b $\frac{\sin x}{x} = 1 - \frac{x^2}{3!} + \frac{x^4}{5!} - \frac{x^6}{7!} + \ldots.$ for all $x \in \mathbb{R}$, $x \neq 0$

page 894 **ANSWERS REVIEW SET 24B**, questions **2 a** and **8 a i**, should read:

2 **a**

n	2	4	6
$M_n(0.1)$	-0.2506	-0.2506	-0.2506
$M_n(1)$	-0.3281	-0.3330	-0.3333
$M_n(2)$	-0.75	-1.25	-1.75

This erratum for **2 a** *was made in error, please disregard it.*

8 **a** **i** $\cos^2 x = 1 - x^2 + \frac{1}{3}x^4 - \frac{2}{45}x^6 + ...$

page 895 **ANSWERS EXERCISE 25D**, questions **2 e** and **2 f**, should read:

2 **e** $Q = Ae^{2t} - \frac{3}{2}$ **f** $Q = -\frac{3}{2} \pm \sqrt{t + c}$

page 896 **ANSWERS EXERCISE 25E**, question **2 d ii**, should read:

2 **d** **i** ≈ 924 rodents **ii** ≈ 23.0 years **iii** 3000 rodents

page 896 **ANSWERS EXERCISE 25F**, question **4**, should read:

4 $x = \pm\sqrt{2}e^{-\frac{\pi}{4}}$ **5** **b** $y = -x\ln\left(\frac{1}{x} + c\right)$

page 897 **ANSWERS REVIEW SET 25B**, questions **7 a**, **11 a**, and **11 b**, should read:

7 **a** $y = (\frac{1}{2}x + 2)^2$ **b** $y = e^{\sin x - 3}$ **8** $y = \dfrac{(x+2)^2}{25(x-2)}$

11 **a** $\dfrac{dV}{dt} = k\sqrt{h}$ **b** $V = 2 \times 2 \times h$, $\dfrac{dh}{dt} = \dfrac{k}{4}\sqrt{h}$

page 907 **ANSWERS EXERCISE 28D.2**, question **10 b**, should read:

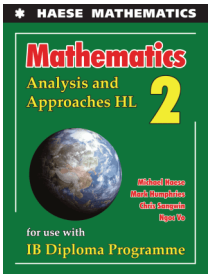
10 **a** $\approx 84.1\%$ **b** ~~≈ 0.879~~ *This erratum for* **10 b** *was made in error, please disregard it.*

The following erratum was made on 22/Oct/2019

page 13 **USEFUL FORMULAE**, COUNTING AND THE BINOMIAL THEOREM, first dot point should read:

COUNTING AND THE BINOMIAL THEOREM

- $\binom{n}{r} = \begin{cases} \dfrac{n!}{r!(n-r)!}, & n \in \mathbb{Z}^+,\ r \in \mathbb{N},\ r \leqslant n \\ \dfrac{n(n-1)(n-2)\ldots.(n-r+1)}{r!}, & n \in \mathbb{Q},\ r \in \mathbb{Z}^+, \text{ and } \binom{n}{0} = 1 \end{cases}$



ERRATA

Mathematics: Analysis and Approaches HL

First edition - 2019 initial print

The following errata were made on 19/Sep/2019

page 285 **EXERCISE 12E**, question **7**, part **i** was removed.

page 329 **EXERCISE 13B**, question **2**, should read:

2 Show that the lines L_1: $x = 2 + 5p$, $y = 19 - 3p$, $z = 9 + 2p$, $p \in \mathbb{R}$
and L_2: $x = 3 + 4r$, $y = 7 + 10r$, $z = -3 + 5r$, $r \in \mathbb{R}$ are perpendicular.

page 361 **REVIEW SET 13A**, question **6 a ii**, should read:

a Find, in terms of **i** and **j**, the:
- **i** initial position vector of the yacht
- **ii** velocity vector of the yacht
- **iii** position vector of the yacht after t hours, $t \geqslant 0$.

page 572 **CHAPTER 21 SECTION D**, blue box should read:

$$\therefore \int (ax+b)^n \, dx = \frac{1}{a} \frac{(ax+b)^{n+1}}{(n+1)} + c \quad \text{for } n \neq -1, \ a \neq 0.$$

page 593 **EXERCISE 22A**, question **16 c**, should read:

16 **c** Solve $\int_0^a x \sec^2 x \, dx = \frac{3}{4}$, $0 < a < \frac{\pi}{2}$ directly using technology.

page 614 **EXERCISE 22G.2**, question **1 a**, should read:

1 Find the volume of the solid formed when the following are revolved through 2π about the y-axis:
a $y = x^2$, $x \geqslant 0$, between $y = 0$ and $y = 4$ **b** $y = \sqrt{x}$ between $y = 1$ and $y = 4$

page 614 **EXERCISE 22G.2**, question **3**, should read:

3 A wooden bowl is made in the shape of a *paraboloid* by revolving the curve $y = \frac{1}{4}x^2$, $x \geqslant 0$, between $y = 0$ and $y = 4$ through 2π about the y-axis. Find the capacity of the bowl.

page 628 **REVIEW SET 22B**, question **22**, should read:

22 Over the course of a day, the rate of solar energy being transferred into Callum's solar panels is given by $E(t) = 2\sin\left(\frac{t-5}{5}\right) + \frac{1}{2}\sin\left(\frac{t-5}{4}\right)$ kW where t is the time in hours after midnight, $5 \leqslant t \leqslant 20$.

page 840 **ANSWERS EXERCISE 12E**, question **7**, part **i** was removed.

page 873 **ANSWERS REVIEW SET 18B**, question **25 b**, should read:

25 **a** $0 \leqslant x \leqslant \frac{\pi}{2}$ and $\frac{3\pi}{2} \leqslant x \leqslant 2\pi$

b $f'(x) = -\dfrac{\sin x}{2\sqrt{\cos x}}$, increasing for $\frac{3\pi}{2} < x \leqslant 2\pi$,
decreasing for $0 \leqslant x < \frac{\pi}{2}$

page 878 **ANSWERS EXERCISE 20C**, question **2 b**, should read:

b The antiderivative of e^{kx} is $\frac{1}{k}e^{kx}$, where $k \neq 0$ is a constant.