ERRATA
MATHEMATICS FOR THE INTERNATIONAL STUDENT
MATHEMATICS SL (3rd edition)

First edition - 2018 seventh reprint

The following erratum was made on 29/Nov/2018

page 694 ANSWERS EXERCISE 5A, question 1 d iv should read:

1 d iv Domain = \{x \mid -5 \leq x \leq 5, \ x \neq -2\},
Range = \{y \mid y < -1, \ -1 < y \leq 0.333\}

The following errata were made on 27/Nov/2018

page 10 SYMBOLS AND NOTATION, bottom left of first column should display symbol:

\begin{align*}
\leq \text{ or } \lessgtr & \text{ is less than or equal to} \\
\gtrless & \text{ is not greater than} \\
\lessgtr & \text{ is not less than}
\end{align*}

page 693 ANSWERS EXERCISE 5A, question 1 b v diagram should correctly display turning point at (0, 2):

\begin{align*}
\text{2 b} & \text{ i} \text{ x-intercepts } -4.97 \text{ and } -1.55, \text{ y-intercept 2} \\
& \text{ ii} \text{ min. turning points } (-3.88, -33.5), \ (0, 2) \\
& \text{ and max. turning points } (-0.805, 2.97) \\
& \text{ iii} \text{ none} \\
& \text{ iv} \text{ Domain } = \{x \mid -5 \leq x \leq 1\}, \\
& \text{ Range } = \{y \mid -33.5 \leq y \leq 12.8\}
\end{align*}

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{turning_point_diagram.png}
\end{figure}

\begin{align*}
\text{page 694 ANSWERS EXERCISE 5A, question 5 c iv should read:}
& 5 \text{ b one solution} \\
& \text{ c i} \ 0 < k < 1 \quad \text{ ii} \ k = 0 \text{ or } 1 \\
& \text{ iii} \ -3 \leq k < 0 \text{ or } 1 < k \leq 8 \quad \text{ iv} \ k < -3 \text{ or } k > 8
\end{align*}

\begin{align*}
\text{page 696 ANSWERS EXERCISE 5D, question 4 a should show graph of } y = x^2 \text{ passing through the origin:}
\end{align*}

\begin{figure}
\centering
\includegraphics[width=0.5\textwidth]{parabola_diagram.png}
\end{figure}

\begin{align*}
\text{The following erratum was made on 15/May/2018}
\end{align*}

\begin{align*}
\text{page 721 ANSWERS EXERCISE 16B, question 2 p should read:}
& 2 \text{ p increasing for } x \geq 1, \text{ decreasing for } 0 < x < 1
\end{align*}

\begin{align*}
\text{page 694 ANSWERS EXERCISE 5A, question 1 d iv should read:}
& 1 \text{ d iv Domain } = \{x \mid -5 \leq x \leq 5, \ x \neq -2\}, \\
& \text{ Range } = \{y \mid y < -1, \ -1 < y \leq 0.333\}
\end{align*}
For the following functions $f$:

i. Find the domain and range.
ii. Find any asymptotes and axes intercepts.
iii. Sketch the graph of $y = f(x)$ showing all important features.
iv. Solve $f(x) = -1$ algebraically and check the solution on your graph.
v. Find $f^{-1}$ and explain how to verify your answer.

a. $f : x \mapsto \log_3(x + 1), \quad x > -1$

b. $f : x \mapsto 1 - \log_3(x + 1), \quad x > -1$

c. $f : x \mapsto \log_5(x - 2) - 2, \quad x > 2$

d. $f : x \mapsto 1 - \log_5(x - 2), \quad x > 2$

e. $f : x \mapsto 1 - 2 \log_2 x, \quad x > 0$
ERRATA
MATHEMATICS FOR THE INTERNATIONAL STUDENT
MATHEMATICS SL (3rd edition)

First edition - 2013 first reprint

The following errata were made on or before 18/Aug/2014

page 26 EXAMPLE 10, solution should read:
  a) For two distinct real roots, \( \Delta > 0 \) \( \therefore k < -9 \) or \( k > -1, \) \( k \neq 0. \)
  b) For two real roots, \( \Delta \geq 0 \) \( \therefore k \leq -9 \) or \( k \geq -1, \) \( k \neq 0. \)

page 59 DOMAIN AND RANGE, first line under the blue box should read:
The domain and range of a relation are often described using interval notation.

page 111 LOGARITHMS IN BASE 10, first blue box on page should read:
In fact, all positive numbers can be written in the form \( 10^x \) by using logarithms in base 10.

The logarithm in base 10 of a positive number is the power that 10 must be raised to in order to obtain the number.

pages 116 and 117 LAWS OF LOGARITHMS, 1st proof should read:

**Proof:**

- \( \log_c (AB) = \log_c (c^{\log_c A} \times c^{\log_c B}) = \log_c (c^{\log_c A + \log_c B}) = \log_c A + \log_c B \)
- \( \log_c (\frac{A}{B}) = \log_c \left(\frac{c^{\log_c A}}{c^{\log_c B}}\right) = \log_c (c^{\log_c A - \log_c B}) = \log_c A - \log_c B \)
- \( \log_c (A^n) = \log_c ((c^{\log_c A})^n) = \log_c (c^{n \log_c A}) = n \log_c A \)

page 128 EXAMPLE 25, part b solution should read:

\[ f(x) = e^{x - 1} \]
\[ f^{-1}(x) = 3 + \ln x \]
RATES OF CHANGE, should read:

- Michael Jordan’s average basketball scoring rate was **30.1 points per game**.

**INVESTIGATION 4**

**GRADIENT FUNCTIONS**

The software on the CD can be used to find the gradient of the tangent to a function \( f(x) \) at any point. By sliding the point along the graph we can observe the changing gradient of the tangent. We can hence generate the gradient function \( f'(x) \).

**EXAMPLE 12**, solution to \( b \) should read:

\[
y = \ln \left[ \frac{x^2}{(x+2)(x-3)} \right]
= \ln x^2 - \ln [(x+2)(x-3)]
= 2 \ln x - [\ln(x+2) + \ln(x-3)]
= 2 \ln x - \ln(x+2) - \ln(x-3)
\]

\[
\frac{dy}{dx} = 2 - \frac{1}{x+2} - \frac{1}{x-3}
\]

**EXAMPLE 12**, question should read:

Find the exact position and nature of the stationary point of \( y = (x-2)e^{-x} \).

**EXAMPLE 12**, should read:

\[
f'(t) = -9.6t \text{ m s}^{-1}
\]

\[
b = -19.2 \text{ m s}^{-1} \quad \text{(the - sign indicates travelling downwards)}
\]

**EXAMPLE 12**, should read:

2 \( a \) \( v(t) = 98 - 9.8t \text{ m s}^{-1}, \quad a(t) = -9.8 \text{ m s}^{-2} \)

The sign diagrams should note the maximum of \( t \):
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The following errata were made before 18/Aug/2014

page 123  EXAMPLE 18, should read:
Consider the equation  \( 2^x = 30 \).
   a  Solve for \( x \), giving an exact answer, by using:  i  base 2  ii  base 10.
   b  Comment on your answers.

page 268  INVESTIGATION, Question 3  b should read:
   b  Use \( \triangle ANP \) and the lengths in a to show that:

page 341  REVIEW SET 13B, Question 2  a ii should read:
   ii  the velocity vector of the yacht

page 433  EXERCISE 17C
13  a  Show that the volume of the container is given by \( V(x) = x(36 - 2x) \) cm\(^3\).

page 434  EXERCISE 17C
18  c  For what value of \( \theta \) does the gutter have maximum carrying capacity? Find the cross-sectional area for this value of \( \theta \).

20  At 1:00 pm a ship A leaves port P. It sails in the direction 30° east of north at 12 km h\(^{-1}\). At the same time, ship B is 100 km due east of P, and is sailing at 8 km h\(^{-1}\) towards P.

page 458  EXERCISE 18E  RULES FOR INTEGRATION  Last formula before the table should read:
   \[
   \frac{d}{dx}(-\cos x + c) = \sin x
   \]

page 510  EXERCISE 20B  Line 1 of question 1 should read:
1  For each of the following data sets, find the:  i  mean  ii  median  iii  mode.

page 627  REVIEW SET 23B  Question 1 should read:
1  A discrete random variable \( X \) has probability distribution function \( P(x) = k \left( \frac{1}{2} \right)^x \left( \frac{3}{2} \right)^{3-x} \) where \( x = 0, 1, 2, 3 \) and \( k \) is a constant. Find:
   a  \( k \)  b  \( P(X \geq 1) \)  c  \( E(X) \).
*Disregard Question 1d

page 670  EXERCISE 25B  Question 33  a should read:
33  Let \( f(x) = \frac{1}{x} \), \( x \neq 0 \).
   a  The graph \( y = f(x) \) and the line \( y = x + 2 \) intersect at \( x = m \pm \sqrt{n} \) where \( m, n \in \mathbb{Z} \). Find \( m \) and \( n \).
**Page 681** ANSWERS EXERCISE 1E

2 a (0.59, 5.59) and (3.41, 8.41)  
 b (3, -4) touching  
 c graphs do not meet  
 d (3.56, -18.81) and (1.56, 1.81)

3 d i ( -4, -1) and (1, 4)  
 ii $x < -4$ or $0 < x < 1$

**Page 681** ANSWERS EXERCISE 1F

15 a $y = -\frac{8}{9}y^2 + 8$

**Page 686** ANSWERS REVIEW SET 2B

7 c ii $x = -\frac{1}{3}$  
 $y = 0$  
 $(-3, -1)$

9 c i $x \approx 1.83$  
 ii $x = -3$

**Page 688** ANSWERS EXERCISE 3F

6 d iii $y \approx 2.62$

**Page 691** ANSWERS EXERCISE 4G

1 e ii VA is $x = 0$  
 x-intercept $\sqrt{2}$,  
 no y-intercept  
 iv $x = 2$

**Page 692** ANSWERS EXERCISE 4H

5 9 years

**Page 693** ANSWERS EXERCISE 5A

1 a i $x$-intercepts $-3, 0$, and $4$, $y$-intercept $0$  
 c iii horizontal asymptote of $y = 0$

**Page 694** ANSWERS EXERCISE 5A

d iii vertical asymptote of $x = -2$,  
 horizontal asymptote of $y = -1$  
 iv Domain $= \{x \mid -5 \leq x \leq 5, x \neq 2\}$,  
 Range $= \{y \mid y < -1, -1 < y \leq 0.333\}$

**Page 702** ANSWERS EXERCISE 7C

3 a $T_{r+1} = \left(\frac{\theta}{\pi}\right)^{2-r}b^r$  
 b $b = -2$

**Page 702** ANSWERS EXERCISE 8B

1 a 49.5 cm, 223 cm$^2$  
 b 23.0 cm, 56.8 cm$^2$

**Page 703** ANSWERS EXERCISE 8C

9 a

<table>
<thead>
<tr>
<th>$\theta$</th>
<th>$\sin \theta$</th>
<th>$\sin(-\theta)$</th>
<th>$\cos \theta$</th>
<th>$\cos(-\theta)$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.75</td>
<td>0.682</td>
<td>-0.682</td>
<td>0.732</td>
<td>0.732</td>
</tr>
<tr>
<td>1.772</td>
<td>0.980</td>
<td>-0.980</td>
<td>-0.200</td>
<td>-0.200</td>
</tr>
<tr>
<td>3.414</td>
<td>-0.269</td>
<td>0.269</td>
<td>-0.963</td>
<td>-0.963</td>
</tr>
<tr>
<td>6.25</td>
<td>-0.0332</td>
<td>0.0332</td>
<td>0.999</td>
<td>0.999</td>
</tr>
<tr>
<td>-1.17</td>
<td>-0.921</td>
<td>0.921</td>
<td>0.390</td>
<td>0.390</td>
</tr>
</tbody>
</table>

**Page 703** ANSWERS EXERCISE 8D.2

2 b $\theta = 0, \pi$, or $2\pi$

**Page 704** ANSWERS EXERCISE 9B

7 a $\theta \approx 75.2^\circ$
The plane's speed in still air would be \( \frac{1}{4} \times 437 \text{ km h}^{-1} \).
The wind slows the plane down to \( 400 \text{ km h}^{-1} \).

\[ x \approx 0.612, \ 3.75, \ 6.90 \]

The plane's speed in still air would be \( \approx 437 \text{ km h}^{-1} \).
The wind slows the plane down to \( 400 \text{ km h}^{-1} \).

\[ x \approx 0.612, \ 3.75, \ 6.90 \]

interception occurred at \( 2^{22}:30 \) pm

\[ \text{bearing} \approx 12.7^\circ \text{ west of south, } \approx 4.54 \text{ units per minute} \]
ANSWERS EXERCISE 14C

1 a

\[ f(t) = 452 - 4.8t^2 \]

b) \( 16e + a^3y = 24a \)

c) \( A = \left( \frac{3}{2}a, 0 \right) \)

d) \( B = \left( 0, \frac{24}{\sqrt{3}} \right) \)

e) Area = \( \frac{18}{4} \) units\(^2\), area \( \to 0 \) as \( a \to \infty \)

ANSWERS EXERCISE 16A

\[ f(x) = \frac{\Delta}{x} \]

b) \( \Delta = 16e + a^3y = 24a \)

c) \( A = \left( \frac{3}{2}a, 0 \right) \)

d) \( B = \left( 0, \frac{24}{\sqrt{3}} \right) \)

e) Area = \( \frac{18}{4} \) units\(^2\), area \( \to 0 \) as \( a \to \infty \)

ANSWERS EXERCISE 16B

6 Increasing for \( x \leq 0 \), decreasing for \( x \geq 0 \)

ANSWERS EXERCISE 16D.1

8 c) Normal has equation \( y = -ex + 1 + e^2 \)

ANSWERS REVIEW SET 16B

7 a) Local minimum at \((0, 1)\) b) As \( x \to \infty \), \( f(x) \to \infty \)

c) \( f''(x) = e^x \), \( x \) thus \( f(x) \) is concave up for all \( x \).

ANSWERS EXERCISE 17B

13 \( 21 \frac{1}{2} \text{ cm}^2 \) per radian

ANSWERS EXERCISE 18E.1

1 c) \( 3e^x - \ln |x| + c \)

d) \( \frac{2}{x^2} - 2 \ln |x| + c \)

e) \(-2x^{-\frac{3}{2}} + 4 \ln |x| + c \)

f) \( \frac{1}{2}x^3 - \frac{1}{2}x^5 + \frac{3}{2}x^3 + c \)

g) \( \frac{1}{4}x^3 + 3 \ln |x| + c \)

h) \( \frac{1}{4} \ln |x| + \frac{1}{4}x^3 - e^x + c \)

i) \( 5e^x + \frac{1}{12}x^4 - 4 \ln |x| + c \)

ANSWERS EXERCISE 18E.1

3 f) \( \frac{1}{2}x^2 + x - 3 \ln |x| + c \)

ANSWERS EXERCISE 18G Question 2, answers c and d switched

2 a) \( \frac{1}{8(1-x^2)^4} + c \)

d) \( \frac{7}{4}(x^3 + x)^{\frac{5}{2}} + c \)

ANSWERS EXERCISE 19C.2

8 a) \( v(t) = \frac{1}{t+1} - 1 \text{ m s}^{-1} \)

b) \( s(t) = \ln |t+1| - t \text{ metres} \)

c) \( s(2) = \ln 3 - 2 \approx -0.901 \text{ m}, \ v(2) = -\frac{2}{3} \text{ m s}^{-1}, \)

\( a(2) = -\frac{1}{3} \text{ m s}^{-2} \)

The object is approximately 0.901 m to the left of the origin, travelling left at \( \frac{2}{3} \text{ m s}^{-1} \), with acceleration \( -\frac{1}{3} \text{ m s}^{-2} \).

ANSWERS REVIEW SET 20B

8 b) Positively skewed c) \( 0 \) \( 0.873 \) \( 0 \)
3 **b** \( r \approx -0.868 \)  
**c** \( y \approx -12.7x + 116 \)

**d** gradient \( \approx -12.7 \). For each extra hour spent on homemade meals, a family spends about $12.70 less each week on fast food.

**y**-intercept \( \approx 116 \) If no time is spent on homemade meals, a family will spend $116 each week on fast food.

4 **d** gradient \( \approx 5.98 \)

Every year a child grows about 5.98 cm taller.

**e** 200 cm - This prediction is not very reliable, as it is an extrapolation well beyond the upper pole. Most children have finished growing taller before 20 years.

5 **a**

![Graph](image)

**b** diameter, \( D \) (cm)

**c**

![Graph](image)

**d**

![Graph](image)

**e**

![Graph](image)

**f**

![Graph](image)

7 **f**

<table>
<thead>
<tr>
<th>i</th>
<th>( \approx 135 ) mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>( \approx 76.0 ) mg</td>
</tr>
</tbody>
</table>

---

**Page 744 ANSWERS REVIEW SET 22B**

1

![Graph](image)

**Page 744 ANSWERS EXERCISE 23A**

2 **c**

<table>
<thead>
<tr>
<th>i</th>
<th>( X = ) number of times the switch is turned on/off before it fails</th>
</tr>
</thead>
<tbody>
<tr>
<td>ii</td>
<td>any integer ( \geq 1 )</td>
</tr>
<tr>
<td>iii</td>
<td>discrete</td>
</tr>
</tbody>
</table>

**Page 745 ANSWERS EXERCISE 23A**

3 **a** \( X = 0, 1, 2, 3, \) or 4

**Page 745 ANSWERS EXERCISE 23B**

4 **a** \( P(X = 0) = 0.665 \)  
**b** \( P(X \geq 1) = 0.335 \)

**Page 746 ANSWERS EXERCISE 23D.3**

1 **a** \( \mu = 3, \sigma \approx 1.22 \)

**b** \( \mu = 1.2, \sigma \approx 0.980 \)

**c** \( \mu = 4.8, \sigma \approx 0.980 \)

2 \( \mu = 5, \sigma^2 = 2.5 \)

3 **a** \( \mu = 1.2, \sigma \approx 1.07 \)

**b** \( \mu = 28.8, \sigma \approx 1.07 \)

**Page 747 ANSWERS REVIEW SET 23B**

1 **a** \( k = \frac{9}{5} \)

**b** \( 0.975 \)

**c** \( 2.55 \)

*Disregard question **d***

**Page 747 ANSWERS REVIEW SET 23C**

2 **b** \( \mu = 2 \)

**c** \( \sigma = 1 \)

**Page 748 ANSWERS REVIEW SET 24C**

3 \( 0.207 \)

**4** \( \mu \approx 80.0 \) cm

**5** \( 0.0708 \) units²

**Page 748 ANSWERS EXERCISE 25A**

1 **a** \( b^2 \)

**b** \( 2 \ln b + x \)

**c** \( x^2 = \frac{2 \ln b}{\beta^2 - 1} \)
\[
f(x) = x^2 - 2x^2
\]