The standard normal distribution or $Z$-distribution is the normal distribution with mean 0 and standard deviation 1. We write $Z \sim N(0, 1)$.

Every normal $X$-distribution can be transformed into the $Z$-distribution using the transformation

$$Z = \frac{X - \mu}{\sigma}$$

- subtracting $\mu$ shifts the mean to 0
- dividing by $\sigma$ scales the standard deviation to 1

What to do:

1. Use your calculator to find:
   - a. $P(0 \leq Z \leq 1)$
   - b. $P(1 \leq Z \leq 2)$
   - c. $P(1 \leq Z \leq 3)$

Have you seen these values before?
The following erratum was made on 27/Mar/2017

page 205  CHAPTER 6 INVESTIGATION 5, HEART STOPPERS table should include ranges for l as low as 3.0:

What to do:

1  Use the data to complete the table:

<table>
<thead>
<tr>
<th>Cholesterol level</th>
<th>Before the experiment</th>
<th>25 participants taking the drug</th>
<th>25 participants taking the placebo</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.0 ≤ l &lt; 3.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 ≤ l &lt; 4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0 ≤ l &lt; 4.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.5 ≤ l &lt; 5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.5 ≤ l &lt; 9.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The following erratum was made on 14/Nov/2016

page 311  CHAPTER 10 INVESTIGATION 2, USING THE Z-DISTRIBUTION should have correct axis label on diagram:

USING THE Z-DISTRIBUTION

The Z-distribution is useful when finding an unknown mean or standard deviation for a normal distribution.

For example, suppose X is normally distributed with mean 40, and P(X ≤ 45) = 0.9.

We can find the standard deviation as follows:

P(X ≤ 45) = 0.9

The following erratum was made on 1/Aug/2016

page 669  ANSWERS REVIEW SET 6C, Question 7 c ii should read:

7 c i Brand Y, as the median is higher.
ii Brand Y, as the IQR is lower, so less variations.
The following errata were made on or before 12/Oct/2015

page 4  **ACKNOWLEDGEMENTS**, should include:

Support material: Marjut Mäenpää

page 46  **SECTION 2.D**, replace URL at the bottom of the page with:

For more information on SI units, visit [www.bipm.org/en/publications/si_brochure/](http://www.bipm.org/en/publications/si_brochure/)

page 110  **EXERCISE 4H.2**, Question 1  **c** should be:

\[
\begin{align*}
    c & : y = \frac{1}{2}x - 3 \\
    & : y = \frac{9}{2} - 2x
\end{align*}
\]

page 226  **EXAMPLE 12**, First paragraph should read:

A platform diving squad of 25 has 18 members who dive from 10 m and 17 who dive from 4 m. How many dive from both platforms?

page 344  **EXAMPLE 8**, Fourth line of the solution should read:

The 2 × 2 contingency table is: The expected frequency table is:

page 480  **REVIEW SET 15B**, Question 9 diagram should be:

![Diagram of a tree with angles 18° and 10°, 50 m distance between the points.]

*The answer printed in the back for this question used this interpretation of the image:

page 647  **MISCELLANEOUS PROBLEMS 22B**, Question 34  **e** should read:

\[ e \] Determine the dimensions \( x \) and \( h \) which maximise the volume of the cuboid.

*Also the answer should be \( h \) instead of \( y \)

page 660  **ANSWERS EXERCISE 4G.2**, Answer 1  **b**  **ii** should read:

\[ b \]  i. \( s = 2 \)  ii. \( s = -4 \)  iii. \( s = 2.4 \)

page 660  **ANSWERS EXERCISE 4H.1**, Answer 2  **d** should read:

\[ d \] \( x = 0 \), \( y = 1.5 \)
EXERCISE 5F.1
1 $6945.75  2 a £17.496  b £2496
3 a ¥1 284 045  b ¥404 045  4 ¥199 713
5 ¥546.01  6 Bank A

EXERCISE 5F.2
2 $5629.65  3 $4079.77  4 ¥14159.08  5 ¥199 713
6 $20 836.86  7 ¥80 000  8 2 years 9 months
9 2 years 9 months  10 13 years 3 months  11 14.5% p.a.
12 6.00% p.a.  13 5.25% p.a.

EXERCISE 5G
1 E 1280  2a E 26 103  b E 83 896
3 a ¥30 013  b ¥57 487  4 24.8%  5 18.4%

EXERCISE 6B
b 1 and 2  c positively skewed, one outlier, (9 students)

EXERCISE 6H, Question 1 e should read:
1 d ≈ 23 students  6 e ≈ 75 marks

EXERCISE 6I.1, should read:
1 a ≈ 1.49  b ≈ 4.73
2 mean = 55 L, standard deviation ≈ 10.9 L
3 mean ≈ 1.69 kg, standard deviation ≈ 0.182 kg
4 a T = 169 cm, s ≈ 6.05 cm  b T = 174 cm, s ≈ 6.05 cm
   c The distribution has simply shifted by 5 cm. The mean increases by 5 cm and the standard deviation remains the same.
5 a T = 1.01 kg, s = 0.17 kg  b T = 2.02 kg, s = 0.34 kg
   c Doubling the values doubles the mean and standard deviation.
6 a ≈ 0.809  b 2.8, from volunteer F  c ≈ 0.150
   d the extreme value greatly increases the standard deviation

EXERCISE 6I.2, Question 6 d should have a labelled axis:

EXERCISE 6A, Question 2 a graph should have a title:

EXERCISE 6B, Question 2 e graph should have a title:
4 a It is neither. b x is zero or a positive rational number.

$4.75

6 a 6.68% b 137 bags 7 162 seconds

1 weak/moderate positive correlation

2 e At $y \approx 52$. This means that we would expect a city with no speed cameras to have approximately 52 car accidents in a week.

1 c There is a strong, positive, linear correlation between the starting salaries for Bachelor degrees and the starting salaries for PhDs.

Country | France | Germany | sum
---|---|---|---
Pass | 64.8 | 105.2 | 169
Fail | 21.2 | 55.8 | 77
sum | 86 | 161 | 247

46.3 m 3 Yen 4 88.2 km

11 a (1.5) b 5.85 m

17.6 cm

8 a No tax is paid on incomes of $6000 or less.
b gradient of AB \approx 0.33, gradient of BC = 0.35. These represent the tax rates for the brackets $6k - $15k and $15k - $42k respectively (in cents per dollar earned).

5 a 

b 40.8 m$^2$
c 4.08 m$^3$

1 a Slant height \approx 1.06 m 
b Hemisphere surface area \approx 4.02 m$^2$ d \approx 3890 kg
page 694 ANSWERS REVIEW SET 15B, Question 9 should read:

8 a 275 m   b 2.86 ha   9 7.32 m

page 695 ANSWERS REVIEW SET 15C, Question 5 a should read:

5 a VS   b XST   c WUS   d a 58.4°   b 68.3°

page 696 ANSWERS REVIEW SET 16C, Question 5 should read:

5 b

<table>
<thead>
<tr>
<th>d (days)</th>
<th>H (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>90</td>
</tr>
<tr>
<td>10</td>
<td>110</td>
</tr>
<tr>
<td>12</td>
<td>130</td>
</tr>
<tr>
<td>14</td>
<td>150</td>
</tr>
</tbody>
</table>

c $H(d) = 3d + 17$
d 53 mm

page 697 ANSWERS EXERCISE 17A, Question 7 d should read:

7 d Domain = \{t \mid 0 \leq t \leq 16\}

page 698 ANSWERS EXERCISE 17C, Question 5 k should read:

5 k 1 and $-0.833$ (or $-\frac{1}{2}$) i 0.434 and $-0.768$

page 704 ANSWERS EXERCISE 19A, Question 2 should have y intercept of -5:

2 a, e

$y = x^4 - 4x^3 + 3x^2 - 5$

page 705 ANSWERS EXERCISE 19A, Question 4 a should include the local minima:

4 a

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

page 707 ANSWERS EXERCISE 19C, Question 3 e should be in square metres:

3 e i $\approx 30$ m²   ii $32$ m²

page 708 ANSWERS EXERCISE 19E, Questions 2 h and 6 a should read:

2 g $x \approx -0.767$, 2 or 4   h $x \approx -0.404$ or 0.882

6 a $x \approx 3.80$   b $-10.1 < k < 2.21$ (3 s.f.)
2 g iv

\[ y = 3x^2 - \frac{4}{x^2} \]

(1.96, 2.00)

\[ x = 0 \]

5 b

(3, 0.0880)

\[ f(x) = 2^x - \frac{1}{x^2} \]

page 711 ANSWERS REVIEW SET 20A, Question 6 should read:

\[ y = -\frac{1}{80}x + \frac{122}{30} \quad \text{or} \quad y \approx -0.0667x + 12.1 \]

page 712 ANSWERS EXERCISE 21A, Question 2 k iii should read:

2 k iii increasing: \( x \leq -2.62, \ x \geq -0.382 \)

decreasing: \( -2.62 \leq x \leq -0.382 \)

page 714 ANSWERS EXERCISE 21C.1, Question 3 b should read:

3 b \( B'(3) = 31.8 \) thousand per day

page 714 ANSWERS EXERCISE 21D.1, Questions 8 d and e should be swapped:

8 a 2x cm  
8 b \( V = 200 = 2x \times x \times h \)
8 c Hint: Show \( h = \frac{100}{x^3} \) and substitute into the surface area equation.

\[ d \frac{dA}{dx} = 8x - \frac{600}{x^2}, \]

\[ \frac{dA}{dx} = 0 \quad \text{when} \quad x \approx 4.22 \]

\( S_{\text{min}} \approx 213 \text{ cm}^2 \)

page 715 ANSWERS EXERCISE 21D.2, Questions 2 and 5 d should note the intervals in which \( x \) lies:

2 a \( AP = (8 - x) \) m, \( BP = \sqrt{x^2 + 16} \) m, \( CP = \sqrt{x^2 + 25} \) m

2 b \( D = 8 - x + \sqrt{x^2 + 16} + \sqrt{x^2 + 25} \)

2 c \( 0 \leq x \leq 8 \)

2 d 2.58 metres from N

5 b \( (13 - x) \) km

5 d 6.26 km from P

\[ C = 6\sqrt{x^2 + 49} + 52 - 4x \]

(6.26, 83.3)
ANSWERS REVIEW SET 21C, Question 3b should read:

iii £9.10 per hour per km h⁻¹

iv £7.50 per hour per km h⁻¹

ANSWERS EXERCISE 22A, Questions 5b, 14b and 21a ii should read:

<table>
<thead>
<tr>
<th>Length (cm)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 &lt; x ≤ 10</td>
<td>15</td>
</tr>
<tr>
<td>10 &lt; x ≤ 20</td>
<td>40</td>
</tr>
<tr>
<td>20 &lt; x ≤ 30</td>
<td>75</td>
</tr>
<tr>
<td>30 &lt; x ≤ 40</td>
<td>50</td>
</tr>
<tr>
<td>40 &lt; x ≤ 50</td>
<td>20</td>
</tr>
</tbody>
</table>

14a £11,737  
14b £212,462.09

21a i 2004.38 yuan    
ii 1974 yuan   
21b 6604.38

ANSWERS EXERCISE 22A, Question 33b should read:

ANSWERS EXERCISE 22B, Question 34e should read:

34d \( \frac{dy}{dx} = 1200 - \frac{1}{x^2} \)

e \( x = 40, \ h = 20 \)
f \( 32000 \text{ cm}^3 \)

ANSWERS EXERCISE 22B, Question 46g and 51a i should read:

46g \( y = -\frac{1}{2}x + \frac{3}{2} \)

51a i x-intercepts are -1.21, 3.75, and 6.24, y-intercept is -11