Excercise Solutions

1. (a) \(y - 4 = 2(x - 3)\), point-slope form

(b) \(y - 5 = \frac{5 - (-1)}{-2 - 6}(x - (-2)) \rightarrow y - 5 = \frac{-3}{4}(x + 2)\), two-point form

You could also have used the other point to get \(y + 1 = \frac{-3}{4}(x - 6)\).

(c) \(y = 3x - 4\), slope-intercept form

2. The distance between (1,2) and (7,10) is \(\sqrt{(1 - 7)^2 + (2 - 10)^2} = \sqrt{100}\). The distance between (1,2) and (5,-1) is \(\sqrt{(1 - 5)^2 + (2 - (-1))^2} = \sqrt{25}\). The distance between (7,10) and (5,-1) is \(\sqrt{(7 - 5)^2 + (10 - (-1))^2} = \sqrt{125}\). We see \((\sqrt{100})^2 + (\sqrt{25})^2 = (\sqrt{125})^2\) so these points create a right triangle.

3. Put both equations in slope-intercept form.

   • \(y = \left(\frac{1}{k}\right)x - \frac{5}{k}\) with slope \(m = \frac{1}{k}\)

   • \(y = -3x + \frac{7}{2}\) with slope \(m = -3\)

For two line to be perpendicular one slope is the negative reciprocal of the other. Set \(\frac{1}{3} = \frac{1}{k}\). Then \(k = 3\).

4. I don’t have a good way to draw graphs. One answer is in the book, see Sec. 8.2 number 11.

5. The operations are

   1. multiply by 5 (or multiply by -5)
   2. subtract from 3 (add 3)
   3. cube
   4. add 4

There are 5 children in line counting the one who receives the paper at the end.

6. (a) \(15 \div 3 = 5\) mph

(b) 1 hour

(c) 3+1=4 hours

(d) 30 miles \(\div\) 4 hours = 7.5 mph

(e) The average of the speed to, which is 5 mph, and the speed back, which is 15 mph, is 10 mph \(\neq\) 7.5.
(f) The graph should show a line from (0,0) to (3,15) and from (3,15) to (4,0).

7. Suppose this is your data: \{3, 5, 6, 4, 2, 4, 3, 6, 7, 0, 3, 4, 6, 3, 6, 1, 1, 5, 7, 4\}.

(a) A relative frequency polygon should have the numbers 0 through 7 on the x-axis for the number of heads which appear on a turn. The y-axis should have fractions for the relative frequency. There should be dots above each number on the x-axis corresponding to the relative frequency. For example, we should have the points \((0, \frac{1}{20} = .05)\), \((1, \frac{2}{20} = .10)\), \((4, \frac{4}{20} = .20)\), etc. Connect the dots with lines.

(b) The mean is 4 and the standard deviation is about 1.97 \(\approx 2\).

(c) The range for one standard deviation is 4-2 to 4+2 which is between 2 and 6. 15 of our data values are between 2 and 6, that is 75%.

(d) The range for two standard deviations is 4-4 to 4+4 which is between 0 and 8. 100% of our values are in this range.

(e) This is not really very close to the 68-95-99.7 rule. It is a little tighter than a normal distribution. However is we used the decimal for the standard deviation instead of rounding up, it probably would be normal.

8. (a) mean = 19.875, median = 18.5, and mode = 18

(b) \(Q_L\) is the median of \{15, 17, 18, 18\} which is 17.5. \(Q_U\) is the median of \{19, 21, 24, 27\} which is 22.5. The IQR = \(Q_U - Q_L = 22.5 - 17.5 = 5\).

(c) An outlier is either less than \(17.5 - 1.5(5) = 10\) or greater than \(22.5 + 1.5(5) = 30\). There are no outliers.

(d) The 5-number summary is 15-17.5-18.5-22.5-27. The box plot has a box between 17.5 and 22.5 with a line through 18.5 and lines from the sides of the box to 15 and to 27.

9. Yes, on a die there is an equal chance of rolling an even number or rolling an odd number.

10. (a) The limits are \(\mu - \sigma = 45 - 5 = 40\) and \(\mu + \sigma = 45 + 5 = 50\).

(b) The limits are \(\mu - 2\sigma = 45 - 10 = 35\) and \(\mu + 2\sigma = 45 + 10 = 55\).

(c) The limits are \(\mu - 3\sigma = 45 - 15 = 30\) and \(\mu + 3\sigma = 45 + 15 = 60\).

(d) The z-score for 33 is \(z = \frac{33 - \mu}{\sigma} = \frac{33 - 45}{5} = -2.4\). The z-score for 46 is \(z = \frac{46 - \mu}{\sigma} = \frac{46 - 45}{5} = 0.2\).

(e) Use the table is the book. The percentile for 33 is .82 and for 46 is 57.93.

11. You would like the z-score of .5. This means your income is .5 standard deviations above average. A z-score of -1 implies your income is 1 standard deviation below average.