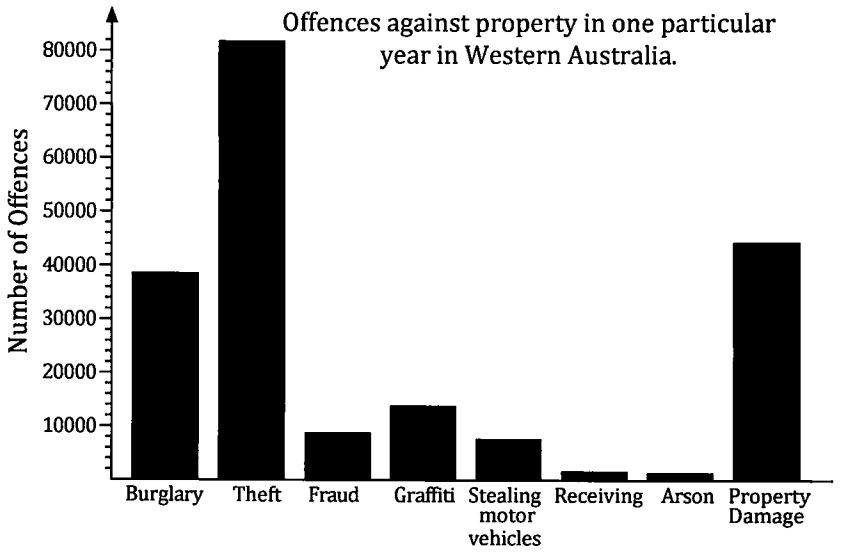
ANSWERS.

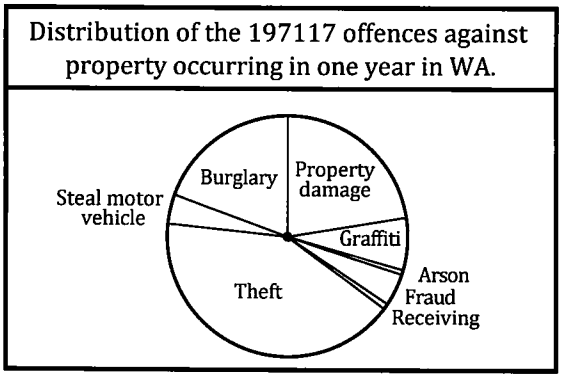
Note
- For questions that do not stipulate a specific level of rounding the answers given here have been rounded to a level considered appropriate for the question.
- If a question asks for an answer to be given "to the nearest centimetre" it does not necessarily have to be given "in centimetres". In such a situation an answer of 174·9256 metres could be written as 174·93 m or as 17493 cm, both answers being to the nearest centimetre.

Exercise 1A. Page 17.

1. Nominal **2.** Nominal **3.** Ordinal
4. Ordinal **5.** Nominal **6.** Ordinal
7. Ordinal **8.** Nominal **9.** Nominal
10. Ordinal **11.** Nominal **12.** Nominal

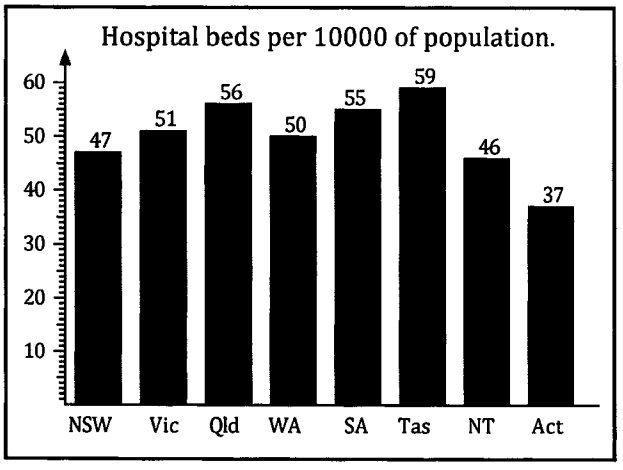
13.





The advantage of the pie chart is that it shows how the total number of offences are divided up – i.e. the numbers of each type of offence as a proportion of the whole is shown. Whilst the pie chart also allows the numbers of each offence to be compared, if two categories are close in number it could be difficult to determine which has the greater number.
The bar chart on the other hand allows for very good comparison between categories but the proportion that each category is of the whole is not so evident.
Both the pie chart and the bar graph shown above fail to show the accurate numbers given in the question but do allow overall comparisons to be made. However this weakness could be overcome if it was felt to be significant by including the accurate figures, with each category title in the pie graph, or at the top of each bar in the bar graph.

14.



Exercise 1B. Page 18.

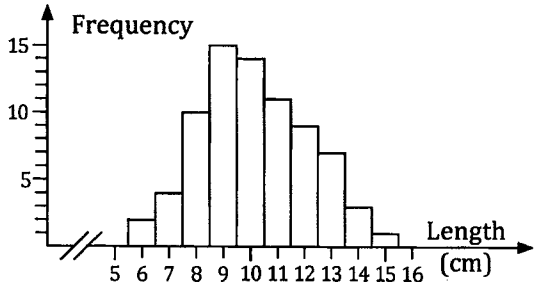
1.	Discrete	**2.**	Continuous	**3.**	Discrete
4.	Continuous	**5.**	Continuous	**6.**	Continuous
7.	Discrete	**8.**	Continuous	**9.**	Discrete
10.	Continuous	**11.**	Continuous	**12.**	Continuous

Exercise 1C. Page 23.

1, 2, 3. Compare your choice with those of others in your class and discuss with your teacher.

4. Compare and discuss your sketches with those of others in your class. Discuss the reasonableness of your sketches and their sketches.

5.



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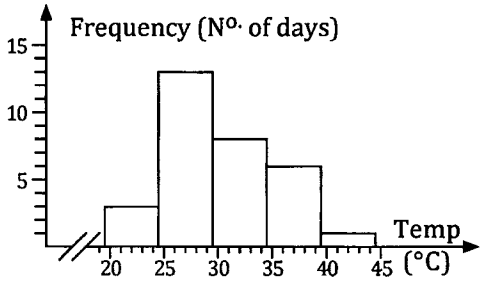

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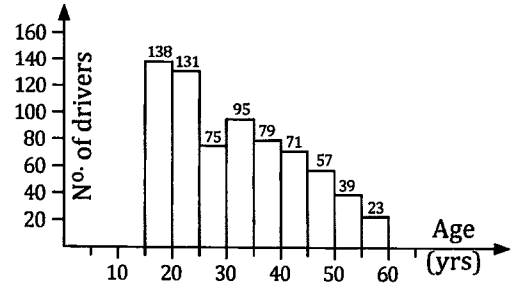
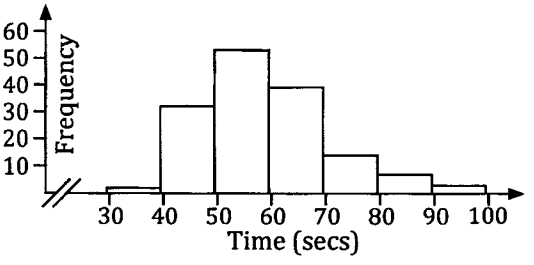


8.

Time (secs)	30 - 39	40 - 49	50 - 59
Frequency	2	32	53

60 - 69	70 - 79	80 - 89	90 - 99
39	14	7	3



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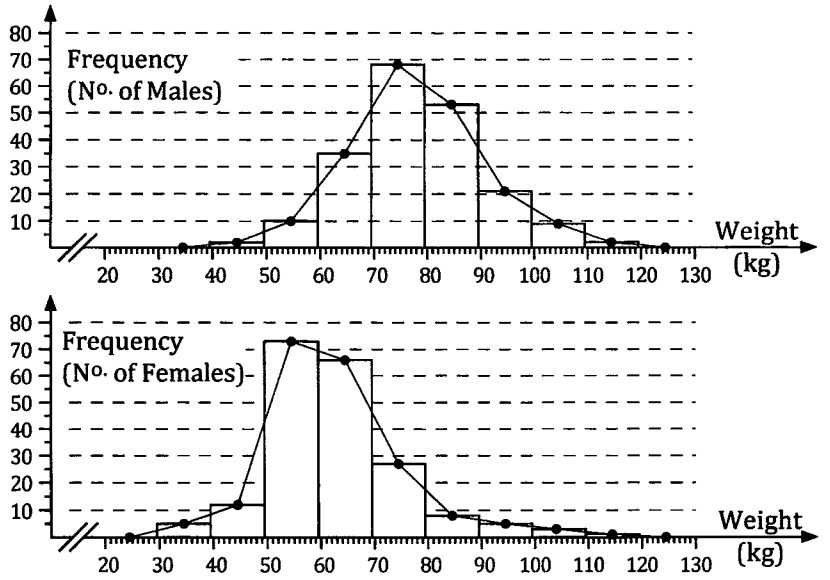

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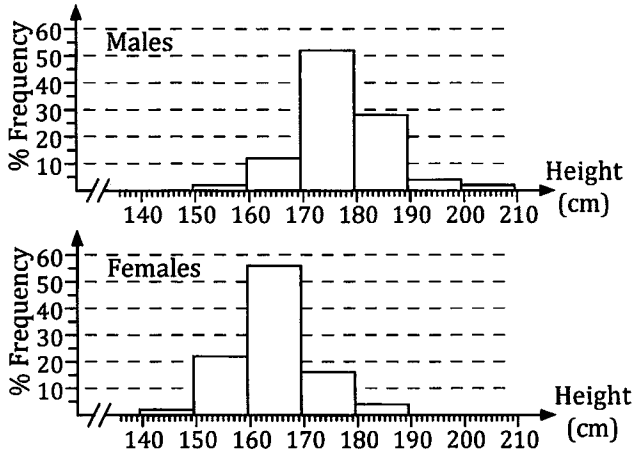


Miscellaneous Exercise One. Page 27.

1. (a) False (b) False (c) False (d) False (e) False (f) False

2. (a) Nominal categorical (b) Continuous numerical
(c) Discrete numerical (d) Nominal categorical
(e) Ordinal categorical (f) Nominal categorical
(g) Continuous numerical (h) Discrete numerical

3. (a) 130 (b) 2·1 (c) 29·3

4. (a) 22 (b) 21 (c) 13·5

5. (a) 3 (b) 13 and 17 (c) 22

6. 7·5 litres of water should be added to 25 millilitres of concentrate.

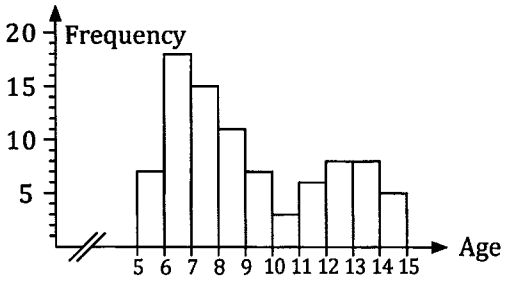
7. (a) mean 37·6, median 38, mode 40, range 7
(b) mean 102, median 107, mode 131, range 63
(c) mean 17·2, median 17·5, mode 18, range 4

8. (a) $15x - 6$ (b) $28 - 8x$ (c) $-6x - 21$
(d) $8 - 16x$ (e) $10p - 35$ (f) $6h - 15$
(g) $7 + 6x$ (h) $-2x - 11$ (i) $-4x + 15$
(j) $7 + 8q$ (k) $7w + 22$ (l) $6p$

9. The framework requires 37 metres of steel (rounded up to the next whole metre).

10. (a) Frequency: 7, 18, 15, 11, 7, 3, 6, 8, 8, 5.

(b)



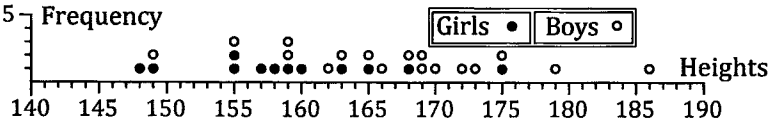
Exercise 2A. Page 33.

1. mean 3·5 (1dp), median 4, mode 5, range 5.
2. mean 5·7 (1dp), median 6, mode 6, range 10.
3. mean 17·6 (1dp), median 18, mode 18, range 5.
4. mean 101·9 , median 102, mode 101 and 103, range 7.
5. mean 6·3 (1dp), median 7, mode 9, range 9.
6. mean 25·2 , median 28, mode 28 and 32, range 36.
7. (a) 118 (b) 164 (c) 139 (d) 139·8
8. (a) 48 (b) 94 (c) 77 (d) 76·4
9. A little less than two.
10. mean 6·3, median 6·5, mode 7.
11. Assuming the teacher is older than 17·2 years, a reasonable assumption given that a school class is involved, the mean would be increased.
12. The eighth score is 75.
13. The mean for the three groups is 57·1%.
14. The student must achieve 86% or more in the tenth item.
15. The mean of the other five scores is 50.
16. The girls achieved a mean of 62·7%.
17. The mean is the same as the median.
18. The mean is greater than the median.
19. The mean is less than the median.
20. The mean is the same as the median.
21. The mean is less than the median.
22. The mean is greater than the median.
23. The mean is the same as the median.
24. The mean is the same as the median.
25. The mean is greater than the median.
26. The mean is greater than the median.
27. The mean is less than the median.
28. The mean is the same as the median.
29. The mean is greater than the median.
30. The mean is less than the median.
31. The mean is greater than the median.
32. The mean is greater than the median.
33 and 34. Answers not given here. Compare your answers with those of someone else in your class and discuss the merits of each.

Exercise 2B. Page 40.

1. Mean 146, median 143, mode 137, range 40
2. Mean 82, median 83, mode 78, range 18
3. Mean 22·8, median 22, no mode, range 32
4. Mean 52·4, median 50, mode 35, range 45
5. Mean 2·3 (1 dp), median 2, mode 3, range 7
6. Mean 8·4 (1 dp), median 9, mode 6, range 7
7. Mean 18·8 (1 dp), median 19, mode 20, range 5
8. 8·5 **9.** 10·5 **10.** 33·1 **11.** 69·0
12. \$447 600, \$439 000. 8 are lower than the mean. 5 are lower than the median.
13. The mean number of bedrooms per house is 3·65.
14. (a) The modal salary is \$68 000.
(b) The median salary is \$68 000
(c) The mean salary is \$73 640
15. The mean number of sunlight hours is 10·9 (1 dp) and the median is 11·1.
16. (a) The mean is 75·4 (1 dp).
(b) The median is 77.
(c) 10 students scored less than 60%.
(d) 10% (3 of the 30) scored greater than 75%.

17. (a) There were 12 girls in the group.
(b) The shortest girl was 148 cm tall.
(c) The mean height for the girls is 159 cm (nearest cm).
(d) The mean height for the boys is 167 cm.
(e) The mean height for the 29 students is 164 cm (nearest cm).
(f)



18. (a) 37·8
(b) 38

Score	21 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50
Freq.	4	7	7	9	13	10

19. (a) $40 \le h < 50$ is the modal class (b) Mean = 44·7 hours

20. (a) Median lies in $230\,000 \le C < 240\,000$ (b) Mean price = \$240 000

Exercise 2C. Page 45. (Answers are given to suggest typical comments that could be made.)

1. The displayed data involves 64 test marks altogether.
Using the mid-point of each class interval gives an estimated mean of 61·25, the median lies in the 60 to 70 interval and the modal class is the 70 to 80 interval.
The marks are spread from about 20 to about 100, a range of approximately 80, but almost all of the marks (61 out of the 64) are actually spread from about 40 to 80.
The 61 marks from 40 to 80 are reasonable evenly spread amongst the four intervals 40 to 50 (15 marks), 50 to 60 (13 marks), 60 to 70 (16 marks) and 70 to 80 (17 marks).
There were no marks between 30 and 40 and none between 80 and 90 so with 1 mark between 20 to 30 and the 2 marks between 90 and 100 the histogram features two "gaps".

2. The displayed data involves 82 lengths altogether.
With length involved it is likely that each class interval shows lengths rounded to the nearest whole centimetre. Using these whole centimetre values gives a mean length of 4·3 cm (to one decimal place).
The median length is in the 3·5 cm to 4·5 cm interval and this is also the modal class.
Whilst the lengths are spread from about 2·5 cm to about 9·5 cm, a range of approximately 7 cm, almost all (77 out of the 82, approx 94%) are actually between 2·5 cm and 5·5 cm.
The 77 lengths from 2·5 cm to 5·5 cm are reasonable evenly spread amongst the three intervals centred around 3 cm (24 lengths), 4 cm (27 lengths) and 5 cm (26 lengths).
The histogram features a "gap" with no lengths between 5·5 cm and 7·5 cm.
5 of the recorded lengths are unusually long compared to the other 77 lengths.

3. The displayed data involves 85 lengths altogether.
With length involved it is likely that each class interval shows lengths rounded to the nearest whole centimetre. Using these whole centimetre values gives a mean length of 6·0 cm (to one decimal place).
The median length is in the 5·5 cm to 6·5 cm interval and this is also the modal class.
The lengths are spread from about 2·5 cm to 9·5 cm, a range of approximately 7 cm.
The distribution of scores is reasonably uniform with each 1 cm class interval containing roughly the same number of lengths (from a low of 10 to a high of 14).
The histogram has no gaps.

4. The displayed data involves 100 lengths altogether.
Using the mid-point of each class interval gives an estimated mean of 37·1 cm.
The median length lies in the 34·5 cm to 39·5 cm interval and this is also the modal class.
The distribution of the lengths is very symmetrical in nature with a tall central column and the frequencies falling away on either side of this centre.
Whilst the lengths are spread from a low of 19·5 cm to a high of 54·5 cm, a range of 35 cm, seventy three of the 100 lengths are between 29·5 cm and 44·5 cm, a range of just 15 cm, i.e. most lengths are close to the central mean and median values.

5. The tabulated data involves 96 scores altogether.
Using the centre of each class interval gives an estimated mean of 30·3 (to one decimal place). The median lies in the 26–30 interval and the modal class is the 21–25 interval.
Although the scores range from about 21 to about 55, a range of 34, the first interval (scores of 21–25) has the highest frequency with approximately 36% of the scores, and the frequencies then decrease as the scores increase.
Almost 60% of the scores are from 20·5 to 30·5 and just less than 5% are from 45·5 to 55·5.

6. The displayed data involves 106 scores altogether.
Using the centre of each class interval gives an estimated mean for the scores of 34·7, to one decimal place. The median lies in the 30 to 40 interval.
The scores are spread from about 0 to about 70, i.e. a range of approximately 70.
The scores are reasonably symmetrically spread about a mid-point of about 35. Frequencies rise on either side of this centre to give a bi-modal appearance peaking at the first interval, 28 scores for which $0 \leq$ score < 10, and again at the last interval, 25 scores for which $60 \leq$ score < 70. Half of the scores are either in this first interval or in the last interval.

Miscellaneous Exercise Two. Page 47.

1. (a) $6x + 15$ (b) $35x - 15$ (c) $-2 + 10x$ (d) $22x - 9$
(e) $-2x + 11$ (f) $4x + 9$ (g) $x + 5$ (h) $14x - 1$

2. Nominal categorical.
(With just two categories, Yes and No, it could also be referred to as binary, or binomial data.)

3.

	Advantages	Disadvantages
Mean	Commonly understood as what we mean by the average. Output from statistical calculators. Every score in the set is used when determining the mean. May not be the central score but likely to be reasonably central if no outliers.	Can be greatly influenced by extreme scores (outliers). May not be one of the scores itself. (For example the mean number of children per married couple may not itself be a whole number of children.)

	Advantages	Disadvantages
Median	As many scores below the median and above so it is central. Not affected by extreme scores. Output from statistical calculators. Easily calculated for small amounts of data. Can simplify measuring tasks - for example to find a median height we need only place the items in order and measure the middle one whereas for the mean we would need to measure all. To determine the median time for a team of 5 cyclists we can stop the clock when the third one crosses the line, we don't need to time them all.	May not be one of the scores itself. Can be tedious to rearrange a lot of scores in order if doing it manually.

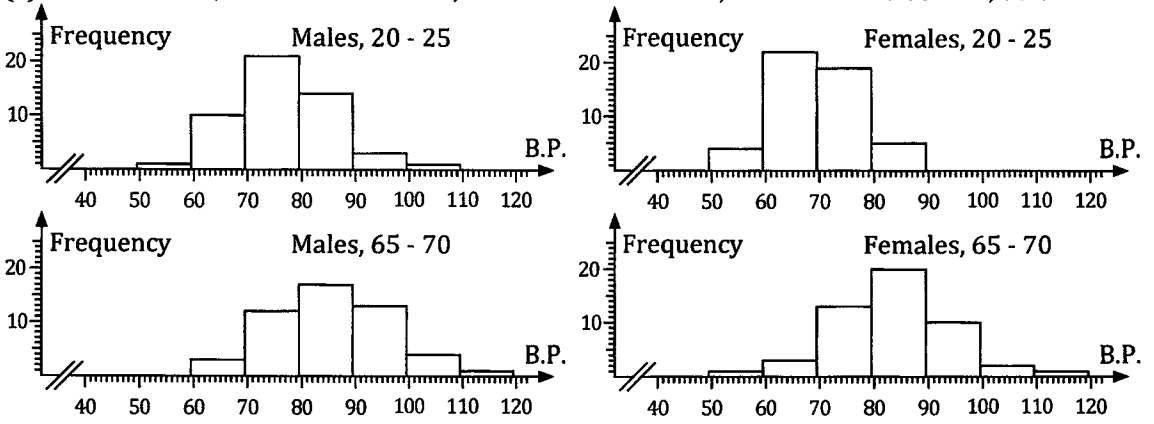
	Advantages	Disadvantages
Mode	It will be one of the scores. Not affected by an isolated outlier. Easy to work out for small data sets. Output from statistical calculators. Gives the most common score.	Not necessarily at all central. There may not be a mode.

4. The student needs at least 102% in test eight , i.e. cannot pass the course.

5. Answers not given here. Compare your answers with those of someone else in your class and discuss the merits of each.

6. Many possibilities, for example: \$14 000, \$15 000, \$16 000, \$17 000, \$18 000, \$88 000.

7. (a) Males 20 – 25, 76·7. Males 65 – 70, 85·7. Females 20 – 25, 69·5. Females 65 – 70, 83·5.



(d) For both sexes the 65 to 70 year olds generally have higher diastolic blood pressures than the 20 to 25 year olds suggesting diastolic blood pressure may increase with age. In both age groups the mean male diastolic blood pressure is higher than the mean for the corresponding female group.

Exercise 3A. Page 51.

1. (a) 31 (b) 42 (c) 38 000

2. (a) 12·8 (b) 18·75

3. (a) 0 (b) 4·72 (2 d.p.) (c) 10·12 (2 d.p.) (d) 7·93 (2 d.p.)

4. (a) B (b) A

5. (a) B (b) A

6. (a) Neither mean is greater, both = 5. (b) A

7. (a) A (b) Neither standard deviation is greater, they are both the same.

8. (a) II (b) II (c) II (d) I

9. Range = 24, mean = 17, standard deviation = 6·58 (2 d.p.).

Exercise 3B. Page 55.

Note: The answers below give σ_n when the standard deviation of a given set of scores is asked for. However it is recognized that in some states σ_{n-1} may be expected to be given whenever the standard deviation is requested. For this reason, if to the given accuracy the two values differ the σ_{n-1} value is shown in brackets.

1. Mean 12·5, Standard deviation 1·7 (1·9)

2. Mean 25·4, Standard deviation 13·5 (14·2)

3. Mean 31, Standard deviation 1·7 (1·9)

4. Mean 6·99, Standard deviation 0·47 (0·49)

5. Mean 30·2, Standard deviation 3·7

6. (a) (i) C (ii) B (iii) A (iv) B

(b) A: Mean = 8·1, Standard deviation = 1·7 (1·8)
B: Mean = 3, Standard deviation = 0·8 (1 dp)
C: Mean = 5·5, Standard deviation = 2·9 (1 dp) (3·0)

7. (a) 5·76, 0·26 (0·28) (b) 5·83, 0·07 (0·08)

8. (a) Yes (b) Yes

9. (a) Mean = 160·44 cm, Standard deviation = 8·87 cm (9·06 cm)

(b) Now use σ_{n-1} because sample is used to predict standard deviation of population.
Estimated standard deviation of population = 9·06 cm.

10. More likely to be a small type B. 18 mm is a little more than 1 standard deviation from the type B mean which is more likely than being 3 standard deviations from the type A mean.

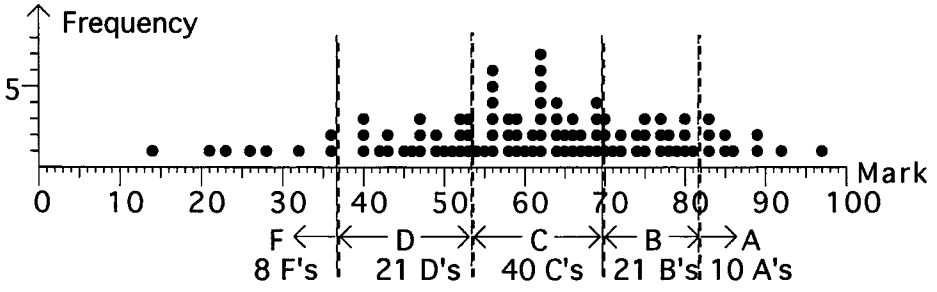
11. (a) Mean = 97·45 cm, Standard deviation = 8·346 cm (3 dp) (8·452 cm)
(b) 80% (c) 92·5% (d) 97·5% (e) 8·45 cm

12. (a) Mean = 155·3°C, Standard deviation = 11·74°C (2 dp) (12·37°C)
(b) Mean = 159·1°C (1 dp) Standard deviation = 2·81°C (2 dp) (2·98°C)

13. 31·5

14. (a) Mean = 30·4°C (1 dp) Range = 19·3°C, Standard deviation = 4·9°C (1 dp). (5·0°C)
(b) The particular year involved has a mean maximum daily temperature for December that is approximately 3°C higher than long term mean.
(c) Mean = 15·8°C (1 dp), Range = 14·4°C, Standard deviation = 3·3°C (1 dp).
(d) The particular year involved has a mean minimum daily temperature for December that is approximately 0·5°C lower than long term mean.

15. (a) Mean = 61·4 (1 dp), Standard deviation = 16·3 (1 dp) (16·4)



16. A passes. B rejected, condition ⑤. C passes. D rejected, condition ③.

Exercise 3C. Page 60.

Note: The answers below give σ_n when the standard deviation of a given set of scores is asked for. However it is recognized that in some states σ_{n-1} may be expected to be given whenever the standard deviation is requested. For this reason, if to the given accuracy the two values differ the σ_{n-1} value is shown in brackets.

1.	Mean 3·1	Standard deviation 1·3	
2.	Mean 32·5	Standard deviation 8·1	(8·2)
3.	Mean 32·5	Standard deviation 14·3	(14·5)
4.	Mean 5·1	Standard deviation 1·8	(1·9)
5.	Mean 70·8	Standard deviation 21·1	(21·2)
6.	Mean 37·25	Standard deviation 8·0	(8·1)
7.	Mean 18·6	Standard deviation 12·9	(13·1)
8.	Mean 37·1	Standard deviation 12·9	
9.	Mean 62	Standard deviation 21·0	(21·4)
10.	Mean 69·6	Standard deviation 16·0	(16·3)

11. (a) 1·8 standard deviations from mean (b) 3·6 standard deviations from mean

12. Uncoated seeds: Mean number of successes per tray = 34·8
Standard deviation = 6·6 (correct to 1 decimal place).
Coated seeds: Mean number of successes per tray = 42·05
Standard deviation = 5·4 (correct to 1 decimal place).
The trays with coated seeds tend to produce more successes per tray with less variability in the number of successes.

13. With outlier: Mean 16·3 minutes Standard deviation 10·9 minutes (11·1 minutes)
Without outlier: Mean 15 minutes Standard deviation 8·3 minutes (8·5 minutes)

14. (a) Mean number of students per school 253, standard deviation 116 (117) (nearest integers).
(b) Mean number of students per school 248, standard deviation 107 (nearest integers).

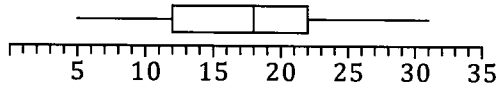
Miscellaneous Exercise Three. Page 64.

1. 0·012, 0·021, 0·1, 0·102, 0·12, 0·2, 0·201, 0·21.
2. $\frac{1}{100}, \frac{1}{5}, \frac{1}{3}, \frac{1}{2}, \frac{3}{5}, \frac{2}{3}, \frac{7}{10}, \frac{3}{4}$.
3. (a) 11 (b) 26 (c) 28 (d) 4 (e) 16 (f) 40
4. A (2, 3), B (5, 4), C (3, 0), D (0, 5), E (2, −3), F (5, −4), G (−2, 3), H (−5, 2), I (−4, −2), J (−2, −4).
5. (a) Nominal categorical.
   (b) For the year in question there were approximately 778 000 apple trees in W.A.
   (c) 2 507 tonnes of peaches were produced commercially.
   (d) (i) The gross value per tonne for oranges was $345
   (ii) The gross value per tonne for nectarines was $1 000
   (e) On average each tree yielded 48 kilograms of apples.
6. Advantage: Easily determined.
   Disadvantage: Only two scores involved so variation amongst other scores not taken into account.
7. Mean 6·68, median 7, mode 9, standard deviation 2·32 (2·38)
8. The new mean is 83·6.
9. The mean birth weight is 3·00 kg (to 2 dp)
10. (a) The survey involved people who were trading in an old vehicle and so all those surveyed had owned at least one vehicle.
    (b) For those surveyed the mean number of vehicles owned prior to the latest purchase is indeed 4·4, to one decimal place, but the two outlying values significantly influence this value. Quoting the median value of 3 vehicles owned prior to the latest purchase may be more representative. Also the median has the advantage of being an integer value and it may be preferable to quote the average as a whole numbers of cars.
11. Each short wire is to be made of length 36·6 metres
    Each medium wire is to be made of length 67·6 metres.
    Each long wire is to be made of length 85·4 metres.
12. (a) Mean 43·92, Standard deviation13·99 (14·28)
    (b) Unit C 1·5, Unit E 0·7, Unit A 0·649 (0·636), Unit B −0·5, Unit D −0·6

Exercise 4A. Page 70.

1. (a) 26 (b) 15 (c) 30 (d) 4 (e) 36 (f) 15
2. (a) 20 (b) 12 (c) 26 (d) 6 (e) 36 (f) 14
3. (a) 14 (b) 12 (c) 16·5 (d) 8 (e) 19 (f) 4·5
4. (a) 61 (b) 50 (c) 80 (d) 20 (e) 93 (f) 30
5. (a) C (b) D (c) A (d) C (e) B (f) C (g) B

6.



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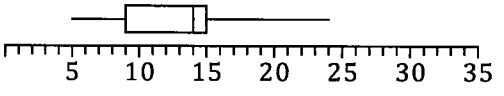

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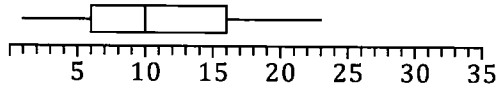
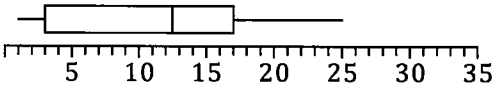


9.



10. (a) The statement is incorrect. There will be the same number of scores below the median as there are above it.
    (b) If we rank spread on the basis of range (32 for class I and 31 for class II) or interquartile range (14 for class I and 13 for class II) then we could say that the class I marks are more spread out than the class II marks. However, even if we only consider these measures there is not much in it. Furthermore box plots do not show us all of the individual marks and the spread summaries of range and interquartile range are each determined using only two scores. Using other criteria to judge spread, for example standard deviation which uses all of the scores in its determination, we could well end up disagreeing with the given statement.

(c) Considering only the range of scores, 34 for class III and 32 for class I, might tempt us to suggest that class III marks are more spread out but the interquartile range, 9 for class III and 14 for class I, suggests the opposite conclusion. The long lower whisker in the class III boxplot could be caused by just one outlying score. Thus whilst the statement could conceivably be correct under some suitably chosen definition of spread it would be unwise to claim the statement true under a more general understanding of "more spread out".

(d) Based on the "five point" nature of the information a box plot provides (i.e. lowest, Q1, median, Q3, highest) the statement seems correct and justified. Were we to know the individual scores we might find the distribution of scores within each quarter differs markedly between the two classes but without this information the statement is a reasonable statement to make based on the boxplot data.

(e) Based on this test the top student in class III would be about 25% of the way down the rank positions of the students in class I, not necessarily the 25th student. Hence the statement is not one that can be concluded from the given information. Box plots do not tell us the number of data points involved.

(f) Class II certainly had at least one student who scored a lower mark than the lowest mark from the other two classes but we cannot conclude that there were "lots" of students for whom this could be said.

Exercise 4B. Page 75.

(Answers are given to most questions to suggest some typical comments that could be made. For the questions for which comments are not given compare and discuss your descriptions with those of others in your class.)

Note: The answers below give σ_n when the standard deviation of a given set of scores is asked for. However it is recognized that in some states σ_{n-1} may be expected to be given whenever the standard deviation is requested. For this reason, if to the given accuracy the two values differ the σ_{n-1} value is shown in brackets.

1. The displayed data involves 42 test marks altogether.
The distribution of marks give a mean mark of 70, the median lies in the 70 to 80 interval and the modal class is also the 70 to 80 interval.
The marks are spread from about 10 to about 90, a range of approximately 80, and the standard deviation is 16·4. (16·5)
The distribution of marks is skewed to the left with 26 of the 42 marks (almost 62%) being 70 or more and 35 of the 42 (approximately 83%) being 60 or more. The distribution features a "gap" with no marks between 30 and 50 but 3 marks were between 10 and 30.

2. The displayed data involves 100 lengths altogether.
The mean length is 5·97 cm and the median length (nearest centimetre) is 6 cm.
Lengths are spread from a low of 3 cm to a high of 9 cm, a range of 6 cm. (However the measurements probably involve rounding so the low could be 2·5 cm and the high could be 9·5 cm to give a range of 7 cm.) The standard deviation of the lengths is 2·3 cm.
The distribution of the lengths is approximately symmetrical in nature about the central value of 6 cm. It is bimodal with peaks at 3 cm and 9 cm. Seventy eight of the 100 recorded lengths are either between 2·5 cm and 4·5 cm or between 7·5 cm and 9·5 cm. The remaining 22 lengths fall in the 4·5 cm to 7·5 cm interval. Hence most of the lengths are situated away from the central mean and median values.

3. The displayed data involves 104 scores altogether.
The distribution of scores give a mean score of 42·0, the median lies in the 30 to 40 interval and the modal class is also the 30 to 40 interval.
The scores are spread from about 10 to about 100, a range of approximately 90, and the standard deviation is 18·2. (18·3)
The distribution of scores is skewed to the right with 74 of the 104 scores being between 10 and 50 and the remaining 30 being between 50 and 100. Just 9 of the 104 scores were between 70 and 100.

4. Comments not given here.
Compare and discuss your descriptions with those of others in your class.

5. The tabulated data involves 100 scores altogether.
The distribution of scores give a mean of 48·05, the median lies in the 46–50 interval and the modal class is the 41–45 class.
The scores are spread from about 31 to about 65, a range of approximately 34, and the standard deviation is 10·04. (10·09)
The distribution of scores is uniform with each class interval containing roughly the same number of scores (from a low of 13 to a high of 16).

6. The tabulated data involves 100 scores altogether.
The distribution gives a mean score of 15·1, the median lies in the $10 \leq x < 20$ interval and is probably much nearer to 10 than it is to 20. The modal class is the $0 \leq x < 10$ interval.
The scores are spread from about 0 to about 70, a range of approximately 70, and the standard deviation is 12·9. (13·0)
With almost half of the scores in the $0 \leq x < 10$ interval and the frequencies decreasing as we move right, the distribution of scores is skewed to the right. Eighty eight of the 100 scores are such that $0 \leq$ score < 30 whilst just 6 are such that $40 \leq$ score < 70.

7. The median of data set A (27) is higher than the median of data set B (24).
With the lower quartile at 20 and the upper quartile at 30 in each set the middle 50% of the data points in each set are spread over the same scores and each data set has an interquartile range of 10. The range of the two data sets is very similar, 34 for set A and 35 for set B. However for data set A the left whisker is the longer whisker, and there is more of the box to the left of the median than the right, indicating that data set A is skewed to the left. Conversely data set B has the right whisker noticeably longer than the left, and more of the box to the right of the median indicating that data set B is skewed to the right.

8. Comments not given here.
Compare and discuss your comments with those of others in your class.

9. Assuming the location of the Regional Meteorology Station to be typical for the region as a whole the region experienced rain on 110 days of the year, i.e. approximately 30% of the days in the year had some rain.
On more than half of the rainy days the rainfall was less than 5 mm. The total rainfall for the year was approximately 775 mm with approximately 8% of this total falling on just one day. If we include the days on which no rain fell the average daily rainfall for the year was approximately 2·1 mm per day. Considering only days on which rain fell the average daily rainfall was approximately 7 mm per rainy day. If we discount the one day of unusually high rainfall these averages become 1·95 mm and 6·5 respectively. For the days that rain fell the rainfall figures have a standard deviation of 8·1 mm but if we discount the one day of unusually high rainfall this falls to 6·1 mm.
The overall distribution is skewed to the right with one extreme value in the 60 to 65 mm interval and all other rainy days recording less than 30 mm.

10. The distribution of scores of the 196 students give a mean score of 83·8. The median score is in the 81 to 90 interval and the modal class is the 91 to 100 interval with approximately 21% of the scores in this interval.
151 of the 196 students (77% of them) achieved a score of over 70 in the exam (remember though that this 70 is a raw score out of at least 120 and is not a percentage score) and 119 of them achieved a raw score over 80.
The students achieved scores from a low of about 21 to a high of about 120, hence the range of scores was approximately 99. The scores had a standard deviation of 20·4.
With the distribution showing a long tail to the left the scores were skewed to the left.

11. The 76 donors involved had a mean age of 36 (nearest year), standard deviation 14.
Their ages ranged from around 15 to almost 60 with a median age of approximately 40.
The 76 recipients involved had a mean age of 44 (nearest year), standard deviation 12.
Their ages ranged from around 15 to mid sixties with a median age of approximately 45.
Thus whilst the ages of the donors and the recipients were spread across similar age ranges, with just six of the recipients older than the oldest of the donors, the donors tended on average to be younger than the recipients.
The age distribution of the donors is bimodal, peaking around 20 and again around 50, and is roughly symmetrical rising on either side of a low frequency central age of approximately 35. In contrast the age distribution of recipients is negatively skewed with frequencies tailing off to the left of the modal age of about 50. Over half of the recipients were between 42 and 58.
Approx 40% of donors but only 15% of the recipients (approx) were aged under 30.

Miscellaneous Exercise Four. Page 78.

1. With the outlier: Mean = 10 Standard deviation = 8·67 (9·19).
Without the outlier: Mean = 7 Standard deviation = 1·87 (2).

2. (a) 1 (b) 1 (c) 2 (d) 3 (e) 1 (f) 2 (g) 75% (h) 2

3. The standard deviation will increase.
If we remove scores that are close to the mean, as those in the central column are, the average distance from the mean will increase. Hence the standard deviation will increase.

4. Ask others in your class to read and comment on your article and you do the same for theirs.

5. A with boxplot 4. B with boxplot 1. C with boxplot 2. D with boxplot 3.

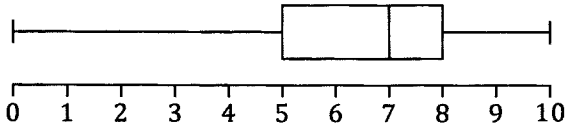
6. (a) Any scores less than 10 or greater than 58.
(b) Any scores less than 3 or greater than 75.
(c) The scores of 10, 17 and 70 are outliers under the given definition.
(d) The scores of 42, 49 and 50 are outliers under the given definition.

7.

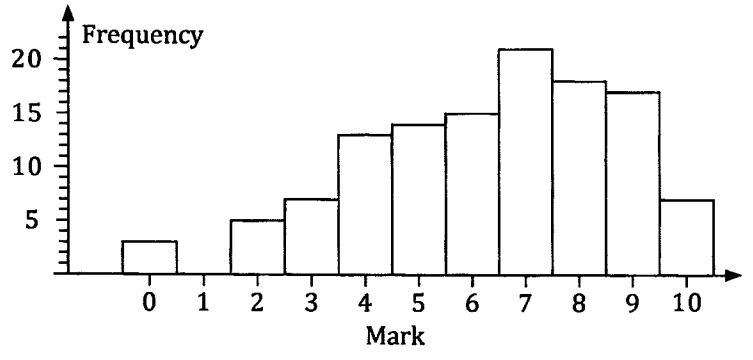
Mark	0	1	2	3	4	5	6	7	8	9	10
Frequency	3	0	5	7	13	14	15	21	18	17	7
Cumulative frequency	3	3	8	15	28	42	57	78	96	113	120

(a) 17 (b) 113 (c) 35% (d) One eighth

(e)



(f)



(g) The marks have a mean of 6·31 and a median of 7. The modal score is also 7.
With the lowest score of zero (3 students) and highest of 10 (7 students) the range of the scores is 10. No student scored a total of 1 but all other possible totals featured.
With a lower quartile of 5 and an upper quartile of 8 the interquartile range is 3.
The standard deviation is 2·35 (2·36) and the distribution is skewed to the left as can be seen from the histogram, as the longer box and whisker to the left of the median than the right suggests, and the fact that mean (6·31) is less than median (7) further reinforces.

8. 3·85 (4·30)

Miscellaneous Exercise Five. Page 83.

1. Histogram with new class intervals not shown here.
Histogram shows that the apparent uniform distribution of times is not the case. The new histogram indicates a distribution that dips on either side of two peaks - i.e. a more bi-modal shape to the distribution. Distribution is reasonably symmetrical about the time of 50 seconds. The apparent uniformity of the original distribution misses the bi-modal feature because the small number of class intervals cause some detail to be lost.

2. (a) $7x + 23$ (b) $16x + 17$ (c) $7x + 2$ (d) $x - 10$ (e) $5x + 18$ (f) $x + 2$

3. (a) 15 (b) 44 (c) 82 (d) 25 (e) 44·7 (f) 15·6 (15·7)

4. (a) Some of the newly diagnosed sufferers will be counted in more than one category, for example a male smoker under 30.
(b) No. Statement not necessarily true. The graphs show *percentage* of newly diagnosed sufferers in each category, the overall *number* of male sufferers could have increased.

Exercise 6A. Page 93.

1. (a) $x = 6$ (b) $x = -26$ (c) $x = 28$ (d) $x = 6$ (e) $x = 4{\cdot}5$ (f) $x = 3$
(g) $x = 4$ (h) $x = 8$ (i) $x = 1$ (j) $x = 13$ (k) $x = 5$ (l) $x = 1{\cdot}4$
(m) $x = 15$ (n) $x = 42$ (o) $x = 5$ (p) $x = 1{\cdot}4$ (q) $x = 84$ (r) $x = 7$
(s) $x = 2$ (t) $x = -1$ (u) $x = 12$ (v) $x = 2$ (w) $x = -0{\cdot}5$ (x) $x = 18$
(y) $x = 13$

2. (a) $P = 650$ (b) $A = 1335$ (c) $I = 55$

3. (a) $v = 20$ (b) $u = 18$ (c) $a = 2$ (d) $a = -3$ (e) $t = 3$ (f) $t = 11$

4. (a) $r = 3{\cdot}98$ (b) $r = 15{\cdot}12$ (c) $C = 50{\cdot}27$ (d) $r = 64$

5. (a) $A = 25{\cdot}13$ (b) $r = 2{\cdot}84$ (c) $h = 5{\cdot}31$

6. (a) $t = 14$ (b) $u = 9$ (c) $v = 15$

7. (a) $R = 11$ (b) $R = 45$ (c) $R_1 = 10$ (d) $R_3 = 27$

8. (a) $h = 5{\cdot}95$ (b) $h = 35{\cdot}79$

9. (a) $V = 25$ (b) $P = 10$ (c) $V = 20$ (d) $P = 2{\cdot}5$

10. (a) $P = 735$ (b) $P = 7840$ (c) $m = 150$ (d) $h = 2{\cdot}25$

11. (a) The cost is \$570.
(b) The cost is \$360.
(c) The person could travel 2 500 km, or less.

12. (a) The commissions received are \$3 100, \$3 400 and \$2 100 respectively.
(b) The house was sold for \$445 000.
(c) The house was sold for \$850 000.

13. (a) The male has an estimated height of 1·7 m.
(b) The expected humerus length is 40 cm.

14. (a) The profit will be \$2 000.
(b) The profit will be \$14 700.
(c) The profit will be \$23 590.
(d) The least number is 3 052.
(e) The firm would make a loss of \$6 890
(f) The greatest profit is \$33 750
(g) The firm would lose \$29 750
(h) The firm must sell at least 2343 calendars to avoid making a loss.

Miscellaneous Exercise Six. Page 96.

1. (a) $x = 7$ (b) $x = 2$ (c) $x = 3{\cdot}5$ (d) $x = 2{\cdot}5$ (e) $x = 14$ (f) $x = 7{\cdot}5$

2. (a) $A = 69$ (b) $h = 2{\cdot}5$

3. a = 3, b = 8, c = 10, d = 12, e = 14.

4. The student requires a mark of 47% or more in test six.

5. (a) A (b) C (c) B (d) A (e) D and B (in that order)

6. 5 A, 9 B, 21 C, 10 D, 2 Fail.

7. The median would be the fairest to use as it will not be unduly influenced by the occasional sale of one of the luxury properties. It might suit the agent to be able to quote a higher average by using the mean, with one or more luxury properties included in the calculation, but for a steadier monthly value that allows a general trend to be observed, free from the occasional monthly "spike" when a luxury property is sold, the median would be more suitable. The mode might occasionally be central but not necessarily, so that too would not be as good as the median.

8. (a) Mean \$65 588 Standard deviation \$16 488 (\$16532)
(b) Mean \$66098 Standard deviation \$16393 (\$16441)

9. Six applicants are invited for interview.

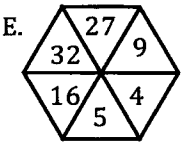
10. Discuss your descriptions with those of others in your class and with your teacher.

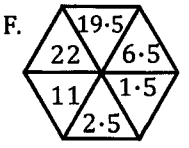
11. (a) Question cannot be answered from the given information. The graphs indicate percentage of the population in the various age intervals, not population numbers.
(b) Approximately nine million of country A's population are aged 70 or over.
(c) Let others read and comment on your report and you read and comment on their report.

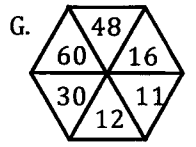
Exercise 7A. Page 102.

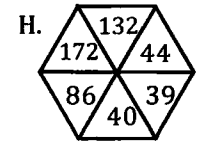
1. 11 **2.** 12 **3.** 2·3 **4.** $1\frac{2}{3}$ **5.** 9 **6.** 2·75

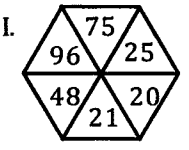
7. (a) 1 (b) 5 (c) 3 (d) add starting number (e) divide by two
(f)

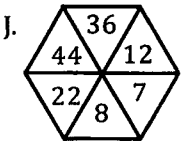
E. 

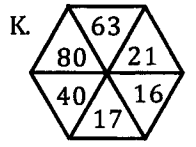
F. 

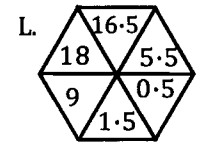
G. 

H. 

I. 

J. 

K. 

L. 

Exercise 7B. Page 106.

1. (a) $5x + 6$ (b) $14 - x$ (c) $5(x + 6)$ (d) $2x - 7$ (e) $2(x - 7)$ (f) $3(2x + 5)$

2. A: $2x + 1 = 10,\ x = 4{\cdot}5$ B: $2(x - 1) = 10,\ x = 6$ C: $10 - x = 1,\ x = 9$

D: $2(x + 1) = 10,\ x = 4$ E: $\frac{x}{2} - 1 = 10,\ x = 22$ F: $x - 10 = 1,\ x = 11$

G: $\frac{x - 1}{2} = 10,\ x = 21$ H: $2x - 10 = 1,\ x = 5{\cdot}5$

3. The number first thought of was 9.

4. The number first thought of was 3.

5. The number first thought of was 10.

6. The number first thought of was 5.

7. The number first thought of was 9.

8. The number first thought of was 5.

9. The number first thought of was 7.

10. The number first thought of was 13.

11. The number first thought of was 9·5.

12. The number first thought of was 12.

Exercise 7C. Page 109.

1. Bob contributes \$6 500, Tony contributes \$12 000.
2. Sue should receive \$12 000, Lyn \$18 000 and Paul \$17 000.
3. Bill is 43 years old now.
4. (a) $\$(5\,000 + 22x)$ (b) 278
5. (a) $3x$ hours (b) $4(120 - x)$ hours (c) 75 standard and 45 deluxe.
6. (a) The width should be 85 m (b) The length should be 95 m. (c) The area should be 8 075 m^2.
7. $(5x - 2)$ years. Heidi is 9 years old now.
8. They need 240 tickets at \$12 each and 610 at \$8 each.
9. (a) $x + 2000$ (b) $2(x + 2000)$
   (c) 3 000 acres of lupins, 5 000 acres of barley and 10 000 acres of wheat.
10. (a) $150x$ grams (b) $80(50 - x)$ grams
    (c) Each 50 kg of *Quickgrow* should contain 32 kg of X and 18 kg of Y.
11. The original order was for 185 hardback and 115 softback
12. \$2 800 was invested with company A and \$2 200 was invested with company B.

Exercise 7D. Page 114.

1. (a) $a = 6$ (b) $b = 4$ (c) $c = 6$ (d) $d = 7{\cdot}5$ (e) $e = 3{\cdot}6$
   (f) $f = 2{\cdot}8$ (g) $g = 1{\cdot}5$ (h) $h = 1{\cdot}7$ (i) $i = 4{\cdot}8$
2. \$4200 needs to be invested.
3. 7·5%
4. The initial investment was \$850.
5. Four and a half years.
6. 146 days
7. Annual rate of 6·5% required.
8. R = 8·2
9. 6% is the required annual rate of simple interest.
10. There were 1463 females in the audience.
11. There are 391 female students in the school.
12. The height of the tree is approximately 13·5 metres.
    Note: Using ratios an "exact" answer of 13·5 metres is obtained. However the word approximately is used in the answer because the nature of the situation means that this answer would have to be regarded as being something of an approximation. Will the highest point of the tree be directly above the centre of the base? Will the end of the shadow be somewhat blurry and difficult to locate accurately? (This applies to some later questions in this exercise too.)
13. The building is approximately 25 metres tall.
14. $h = 3{\cdot}5x$. If $x = 1{\cdot}5$, $h = 5{\cdot}25$.
15. The flagpole is approximately 7 metres tall.
16. The river is approximately 54 metres wide.
17. The pylon is approximately 8·6 metres tall.
18. Mary borrowed \$1200 in the first place.
19. Mai borrowed \$6800 in the first place.

Miscellaneous Exercise Seven. Page 119.

1. There are 342 female students in the school.
2. (a) $x = 4{\cdot}2$ (b) $x = 7{\cdot}5$ (c) $x = 8{\cdot}75$ (d) $x = 2{\cdot}8$
3. $m = 15$
4. 8
5. (a) 86 (b) 79 (c) 7 (d) 9
   (e) Naomi is correct in her statement that the range of the male scores is bigger than the range of the females. ($\text{Range}_{\text{Male}} = 9$, $\text{Range}_{\text{Female}} = 7$).
   However the range depends only on the lowest score and the highest score so it is unwise to claim that the male scores as a whole are more spread out than the female scores based solely on this fact. Indeed other measures of spread namely the interquartile range (5 for female and 2 for male) and the standard deviation (2·4 for female and 2·0 for male) disagree with Naomi's statement and suggest that the female scores are more spread out than the male scores.

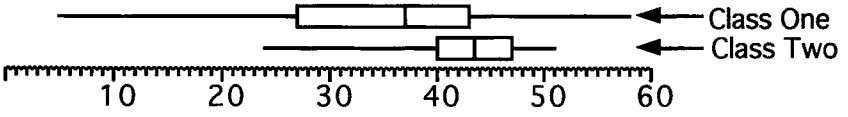
6. The number first thought of was 18.

7. At least \$14 650 needs to be invested for the account to be at least \$19 000 in 5 years.

8. \$54 000 into the account paying 6·3% and \$26 000 into the account paying 5·4%.

9. (a) 70·5 (b) Mean 68 Standard deviation 26·5

10.

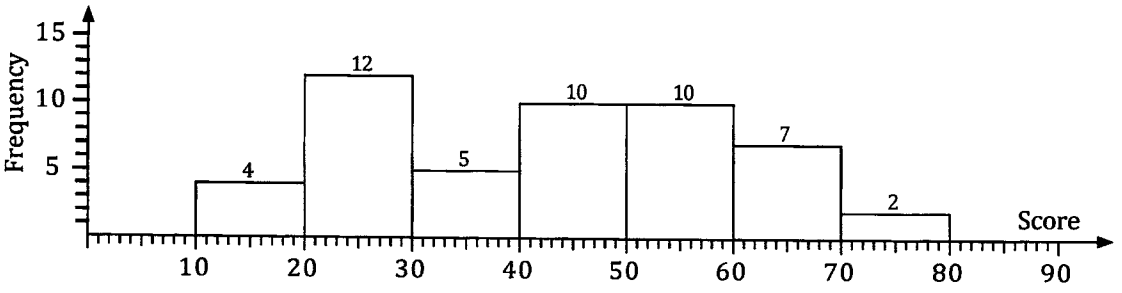


Overall class two performed better even though top mark was in class one:
The median for class one (37) is lower than the median for class two (43·5).
Having the individual scores available we can also determine the means: 34·7 for class one and 42·5 for class two.
The upper quartile in class one is lower than the median in class two.
The marks of class one are more spread out than those of class two:
The range of class one (53) greatly exceeds the range of class two (27) as does the interquartile range (16 for class one compared to 7 for class two).
Having the individual scores available we can also determine the standard deviations: 12·2 (12·5) for class one and 6·2 (6·3) for class two.
The box plot for class one suggests a reasonably symmetrical distribution perhaps skewed left a little as suggested by the longer left whisker and the greater part of the box being to the left of the median. The class two boxplot also suggests a skew to the left because of the longer left whisker though within the box the median is centrally placed. (Such skewness is further suggested by the fact that mean < median in each class.)
The two distributions were based on a very similar number of data points, 25 for class one and 22 for class two.

11. Many possible answers but all must have:

- a total of 50 scores,
- at least one score in the 10 → 20 interval (as lowest score was 16),
- the 13th score (counting from the low end) in the 20 → 30 interval (as 1st quartile = 26),
- the mean of the 25th and 26th score in the 40 → 50 interval (as median was 46),
- the 13th score (counting from the top end) in the 50 → 60 interval (as 3rd quartile = 56),
- at least one score in the 70 → 80 interval (as highest score was 72).

One possibility is shown below:



12. $x = 64\,000$.

Exercise 8A. Page 125.

1. 2	**2.** 0·5	**3.** 1	**4.** -1	**5.** -0·5
6. 2	**7.** -0·5	**8.** 3	**9.** -2	**10.** 1
11. 2	**12.** -1	**13.** -2	**14.** $-\frac{1}{3}$	**15.** 5
16. 1	**17.** 3	**18.** 0·2	**19.** 5	**20.** -20

21. Points would lie in a straight line. Gradient = 2.

22. Points would lie in a straight line. Gradient = –2.
23. Points would not lie in a straight line.
24. Points would not lie in a straight line.
25. Points would lie in a straight line. Gradient = 5.
26. Points would not lie in a straight line.
27. Points would lie in a straight line. Gradient = –5.
28. Points would not lie in a straight line.
29. Points would lie in a straight line. Gradient = –3.
30. Points would lie in a straight line. Gradient = 3.
31. Points would lie in a straight line. Gradient = 2.
32. Points would lie in a straight line. Gradient = 3.
33. Points would not lie in a straight line.
34. Points would lie in a straight line. Gradient = 2·5.

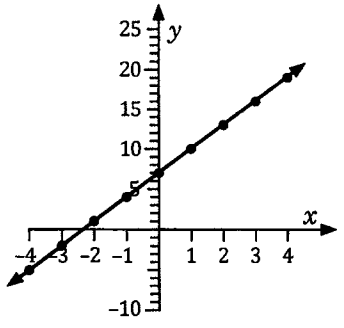
Exercise 8B. Page 133.

1. (a) 1 (b) (0, 2) (c) $y = x + 2$
2. (a) 2 (b) (0, –3) (c) $y = 2x - 3$
3. (a) –1 (b) (0, 3) (c) $y = -x + 3$
4. (a) 0·5 (b) (0, 3) (c) $y = 0{\cdot}5x + 3$
5. (a) –3 (b) (0, 2) (c) $y = -3x + 2$
6. (a) –2 (b) (0, –3) (c) $y = -2x - 3$
7. (a) 40 (b) (0, 10) (c) $y = 40x + 10$
8. (a) 5 (b) (0, 4) (c) $y = 5x + 4$
9. (a) 6 (b) (0, 15) (c) $y = 6x + 15$
10. (a) –10 (b) (0, 70) (c) $y = -10x + 70$
11. A: $y = 7$, B: $y = 4$, C: $y = 1$, D: $y = -4$,
E: $x = -4$, F: $x = -3$, G: $x = 2$, H: $x = 4$.
12. Relationship is linear. $y = 3x + 1$
13. Relationship is linear. $y = -4x + 25$
14. Relationship is linear. $y = 5x - 3$
15. The relationship is not linear.
16. Relationship is linear. $y = 1{\cdot}5x + 0{\cdot}5$
17. The relationship is not linear.
18. Relationship is linear. $y = x + 2$
19. The relationship is not linear.
20. Relationship is linear. $y = -x + 13$
21. Relationship is linear. $y = 2x + 21$
22. Relationship is linear. $y = 3x + 4$
23. Relationship is linear. $y = 5x - 12$
24. Relationship is linear. $y = 2x - 2$
25. Relationship is linear. $y = 3x + 1$
26. (a) 5 (b) (0, –10) (c) $y = 5x - 10$
27. (a) –6·25 (b) (0, 37·5) (c) $y = -6{\cdot}25x + 37{\cdot}5$

28. Table:

x	–4	–3	–2	–1	0	1	2	3	4
y	–5	–2	1	4	7	10	13	16	19

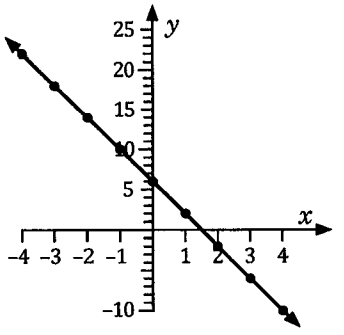
Rule: $y = 3x + 7$
Graph:



29. Table:

x	–4	–3	–2	–1	0	1	2	3	4
y	22	18	14	10	6	2	–2	–6	–10

Rule: $y = -4x + 6$
Graph:

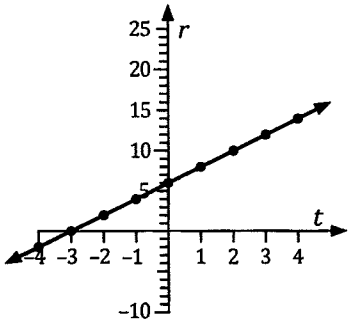


30. Table:

t	-4	-3	-2	-1	0	1	2	3	4
r	-2	0	2	4	6	8	10	12	14

Rule: $r = 2t + 6$

Graph:

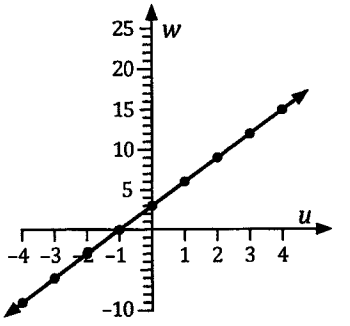


31. Table:

u	-4	-3	-2	-1	0	1	2	3	4
w	-9	-6	-3	0	3	6	9	12	15

Rule: $w = 3u + 3$

Graph:

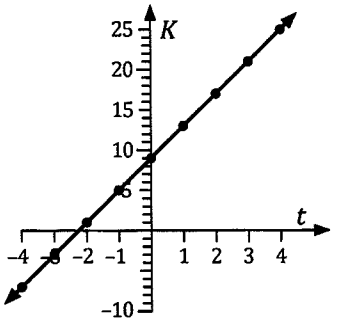


32. Table:

t	-4	-3	-2	-1	0	1	2	3	4
K	-7	-3	1	5	9	13	17	21	25

Rule: $K = 4t + 9$

Graph:

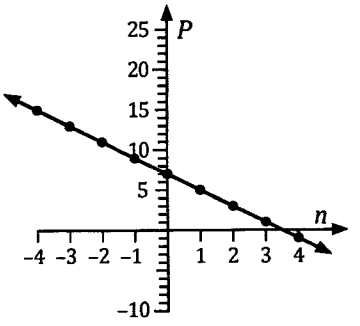


33. Table:

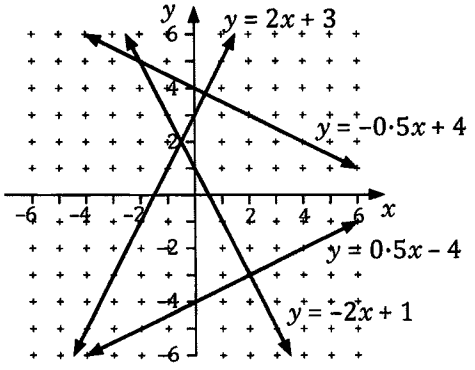
n	-4	-3	-2	-1	0	1	2	3	4
P	15	13	11	9	7	5	3	1	-1

Rule: $P = -2n + 7$

Graph:



34.



35. A: $y = -\frac{2}{3}x + 2$

B: $y = -1{\cdot}5x + 3$

C: $y = 2{\cdot}5x + 4$

D: $y = 4x$

E: $y = 3x$

F: $y = 3x - 2$

36. A: $y = -2$

B: $y = 0{\cdot}5x + 2$

C: $y = -x + 2$

D: $y = 2x - 2$

E: $y = 0{\cdot}5x - 2$

37. A: $y = 10x + 60$

B: $y = 30$

C: $y = -10x + 30$

D: $y = 30x$

E: $y = 30x - 90$

38. The graphs appear different because the scales used on the axes are not the same in the two graphs. Hence the intercepts with the y-axes appear different but in both cases will be at (0, 3) and the intercepts with the x-axes appear different but in both cases will be at (-1·5, 0).

Exercise 8C. Page 141.

1. (a) 2 (b) 4 (c) 2 (d) 0·5 (e) 0·25 (f) 1
(g) −2 (h) 2·5 (i) 0·5 (j) −4 (k) 2·5 (l) 0·5

2. (a) Gradient 3 Cuts y-axis at (0, −17) (b) Gradient −2 Cuts y-axis at (0, 13)
(c) Gradient −7 Cuts y-axis at (0, 5) (d) Gradient $-\frac{2}{3}$ Cuts y-axis at (0, 8)
(e) Gradient −0·4 Cuts y-axis at (0, 1·6) (f) Gradient $\frac{2}{3}$ Cuts y-axis at (0, 3)
(g) Gradient −0·5 Cuts y-axis at (0, 11) (h) Gradient −2·5 Cuts y-axis at (0, 15)
(i) Gradient −1·2 Cuts y-axis at (0, 12)

3. $y = 0$ **4.** $x = 0$ **5.** A does not, B does not, C does, D does not, E does.

6. H and I. **7.** $y = 3x + 4$, Yes

8. $y = 0{\cdot}5x + 2$, D and E **9.** $a = 1$, $b = -1$, $c = -13$, $d = 0$, $e = 9$, $f = 0$.

10. (a) $y = x + 2$ (b) $y = -x + 5$ (c) $y = -2x + 8$ (d) $y = 5x + 8$
(e) $y = 0{\cdot}5x + 5$ (f) $y = -0{\cdot}5x - 1{\cdot}5$ (g) $y = 1{\cdot}5x - 11{\cdot}5$ (h) $y = -\frac{1}{3}x + \frac{4}{3}$

11. (a) $y = x + 3$ (b) $y = -4x - 1$ (c) $y = -3x + 43$ (d) $y = 2x - 1$
(e) $y = \frac{1}{3}x + \frac{5}{3}$ (f) $y = -2x + 4$ (g) $y = \frac{5}{3}x + 4$ (h) $y = -5x + 5$

Exercise 8D. Page 143.

1. (a) $F = 1{\cdot}8C + 32$
(b) The value of m tells us the increase in the Fahrenheit temperature for each 1 degree increase in the Centigrade temperature.
(c) 131°F (d) 14°F (e) 15°C (f) −20°C
(g) Yes there is such a temperature. −40°C = −40°F.

2. (a) The value of k tells us the increase in the length of the spring for each kilogram suspended from it.
(b) The value of L_0 tells us the length of the spring when no weight is suspended from it i.e. it is the unstretched length or natural length of the spring.
(c) $k = 0{\cdot}2$, $L_0 = 0{\cdot}45$, 5cm.

3. A: (−80, 20) B: (120, 120) C: (−100, 60) D: (−60, −20) E: (100, 160) F: (140, 80)
(b) $y = 0{\cdot}5x + 60$ (c) $y = -2x - 140$ (d) $y = -2x + 360$

4. (a) The value of m tells us how much the amount to be paid increases in dollars for each extra unit used. It is the cost per metered unit.
(b) The value of c tells us the cost in dollars that we are charged even if we use no units. It is the "standing charge".
(c) $A = 0{\cdot}24N + 40$ (d) \$88 (e) 175 units

5. (a) $y = 2{\cdot}4x$ (b) $y = x$ (c) $y = 0$
(d) $y = x - 7$ (or in real life units $y = x - 175$) (e) $y = -0{\cdot}4x + 14$ (or $y = -0{\cdot}4x + 350$)

6. The gradient of the line, m, gives the amount the cost of the job increases for each hour increase in the time taken to do the job. It is the hourly rate charged.
The vertical axis intercept, c, gives the "call out fee" i.e. the amount that is charged for arriving at your door (the hourly rate then goes on top of this).
The rule is $C = 120T + 80$

7. $C = 4{\cdot}90 + 1{\cdot}85x$

8. $V = 1000 - 0{\cdot}2t$

9. $P = 75n - 800$

10. $P = 8x$

11. $t = \frac{k}{3} + \frac{1}{3}$

12. $P = 4{\cdot}5N - 3650$

(a) The value of m is 4·5 and this tells us that each extra ticket sold raises the profit by \$4·50.

(b) The value of c is −3650 which tells us that if no tickets are sold the loss will be \$3650.

(c) \$3100

(d) \$6925

(e) 812

13. (a) 110, 540 (b) \$1660

14. $N = 40t + 210$

The value of m is 40 which tells us that the membership is increasing at approximately 40 members per year.

The value of c is 210 which tells us that at the beginning of the 5 year period there were approximately 210 members in the club.

If the linear relationship continues then when $t = 10$ the membership would be approximately 610.

15. (a) $P = 15x - 3750$

(b) The company needs to sell at least 917 copies for a profit of more than \$10000.

16. (a) The 5740 tells us that when the monitoring program started there were approximately 5740 of these animals thought to be in existence in the wild.

The 350 tells us that the numbers of these animals thought to be in existence in the wild is decreasing at approximately 350 per year.

(b) Graph not shown here.

(c) (16·4, 0). If the rate of decline continues there will be none of these animals in existence in the wild approximately sixteen and a half years after the monitoring program commenced.

Miscellaneous Exercise Eight. Page 148.

1. A: $x = 4$ B: $y = -3$ C: $y = x$ D: $y = x + 2$ E: $y = 2x + 4$

F: $y = -x$ G: $y = 0{\cdot}25x + 4$ H: $y = 0{\cdot}5x + 1$ I: $y = -0{\cdot}5x - 1$

2. Equation 3 must be true.

3. (a) $a = 2{\cdot}4$ (b) b = 3·5 (c) c = 6 (d) $d = 3{\cdot}8$

(e) e = 13·5 (f) $f = 13{\cdot}5$ (g) $g = 4{\cdot}5$ (h) $h = 3\frac{5}{9}$

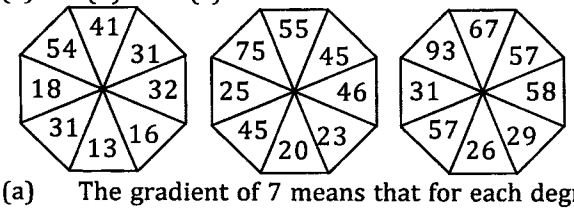
4. There are 196 females in this workforce.

5. The student needs at least 66% in the final unit.

6. Dot frequency 1 with Boxplot C
Dot frequency 2 with Boxplot A
Dot frequency 3 with Boxplot D
Dot frequency 4 with Boxplot B

7. (a) 72 (b) 39 (c) 51

8.



9. (a) The gradient of 7 means that for each degree rise in temperature the number of chirps per minute goes up by 7.

In theory the −16 suggests that at 0°C the cricket would make −16 chirps! However "negative chirps" is a rather meaningless concept. The equation is really only valid for $N \geq 0$.

(b) For $N \geq 0$ we need the temperature to be greater than 2·3°C. Indeed, according to the rule, for at least one chirp per minute the temperature needs to be approximately 2·5°C.

(c) (i) The cricket makes roughly 82 chirps per minute.

(ii) The cricket makes roughly 180 chirps per minute.

(d) (i) The temperature is approximately 31°C.

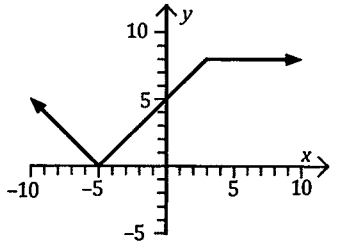
(ii) The temperature is approximately 24°C.

Exercise 9A. Page 153.

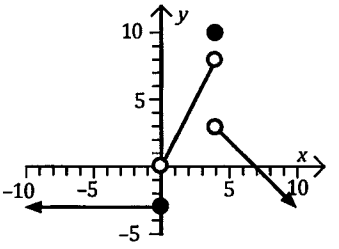
1. For $x < 0$ $y = -x - 4$
for $0 \le x < 4$ $y = 2x - 4$
for $x \ge 4$ $y = 4$

2. For $x \le -4$ $y = 5$
for $-4 < x < 0$ $y = 3$
for $0 \le x \le 3$ $y = -x$
for $x > 3$ $y = x - 3$

3.



4.



5. Ask someone in your class to read and constructively comment on your answer and you do the same for theirs.

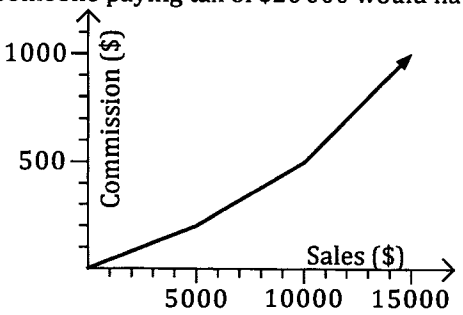
6. (a) The broken line represents the journey of the cyclist.
(b) The cyclist passes the walker between 8.52 a.m. and 8.53 a.m.
(c) The walker took 30 minutes to walk to school.
(d) The walker maintained a steady speed of 6 km/h.
(e) The cyclist took 10 minutes to ride to school.
(f) The cyclist maintained a steady speed of 18 km/h.

7. (a) The cyclist left town A at 7 a.m.
(b) The cyclist reached town B at 11.20 a.m.
(c) For the cyclist each stop was for 30 minutes.
(d) (i) Prior to the first stop the cyclist maintained 20 km/h.
(ii) Between the two stops the cyclist maintained 15km/h.
(iii) After the second stop the cyclist maintained 30 km/h.
(e) (i) From town A to town B the delivery truck maintained 60 km/h.
(ii) From town B back to town A the delivery truck maintained 90 km/h.
(f) When they were both travelling towards B the delivery truck passes the cyclist at about 9.35 a.m., and about 36 km from A.
(g) When returning to A the truck passed the cyclist at about 11.05 a.m., and about 52 km from A.

8. (Graph not shown here.)
(a) The car reaches C at 11.54 a.m. and truck reaches town C at 12.15 p.m.
(b) From 8.30 a.m. to 9.30 a.m. the truck maintained a steady speed of 100 km/h.
(c) The average speed of the truck from A to B was 87 km/h (to the nearest km/h).
(d) The car passes the truck at 10.30 a.m. in town B, just as the truck is about to leave B.

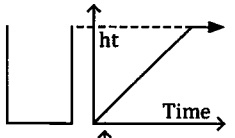
9. (a) Someone with a taxable income of $30 000 would pay $7 000 in tax.
(b) Someone with a taxable income of $40 000 would pay $11 000 in tax.
(c) Someone with a taxable income of $48 000 would pay $15 000 in tax.
(d) Someone with a taxable income of $3 000 would pay no tax at all.
(e) Someone paying tax of $20 000 would have a taxable income of $58 000.

10.

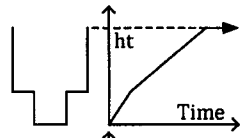


11. For the first \$100 000 of the sale price the agent's fee is a fixed \$6 000.
From \$100000 to \$300 000 the fee is \$6 000 plus 5% of the amount over \$100 000.
From \$300 000 and over the fee is \$16 000 plus 2% of the amount over \$300 000.

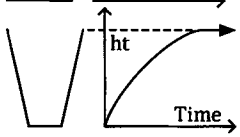
12. (a)



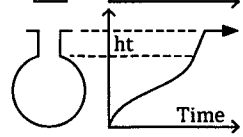
(b)



(c)



(d)



Miscellaneous Exercise Nine. Page 157.

1. $P = 3t - 5$

2. $a = -1$, $b = 4$, $c = 9$, $d = 19$, $e = 29$, $f = 11$, $g = 99$

3. A: $y = -3$ B: $y = 1$ C: $y = -0{\cdot}5x + 5$ D: $x = 5$ E: $y = x + 3$
F: $y = 9$ G: $x = -3$ H: $y = 3x + 2$ I: $x = 7$ J: $y = x$

4. (a) The 5200 and the 16 tell us that the fixed cost of production is \$5200, even when no radios are produced, and then each radio produced adds \$16 to this cost of production.
(b) When 100 radios are produced the mean cost per radio is \$68.
(c) When 500 radios are produced the mean cost per radio is \$26·40.
(d) When 1 000 radios are produced the mean cost per radio is \$21·20.

5. There are 210 year eight students in the school.

6. 4

7. The number first thought of was 6.

8. There were 5 eights in the set.

9. (a) 33 (b) 37 (c) 16 (d) 30 – 40 (e) 31·8

10. (a) 25%
(b) The range of the set B marks (39) exceed the range of the set A marks (32).
The interquartile range for set B (17) exceeds the interquartile range of set A (11).
(c) The median of those left in set B would be lower than that of set B before the move.
(d) The range of those left in set B would be less than that of set B before the move.
(e) The range of the set A scores would be unchanged.
(f) The interquartile range would be reduced.

Exercise 10A. Page 169.

1. (a) 0·34 (b) 0·98 (c) 0·36 (d) 0·84 (e) 3·08 (f) 0·60 (g) 0·77 (h) 0·77

3. (a) 11·5 (b) 66·4 (c) 52·4 (d) 17·5 (e) 75·5 (f) 53·1 (g) 63·4 (h) 25·8

4. (a) 1·3 (b) 3·4 (c) 2·9 (d) 20·5 (e) 14·0 (f) 12·6

5. (a) 23·6 (b) 44·4 (c) 54·5

6. (a) $\frac{a}{b}$ (b) $\frac{c}{b}$ (c) $\frac{a}{c}$ (d) $\frac{a}{b}$ (e) $\frac{c}{b}$ (f) $\frac{c}{a}$

7. $p^2 = q^2 + r^2$

8. (a) (i) 5·3 (ii) 5·27 (b) (i) 31 (ii) 31·0

9. 2·6 **10.** 11·2 **11.** 9·8 **12.** 9·0 **13.** 4·1 **14.** 6·3 **15.** 16·5

16. 12·8 **17.** 9·6 **18.** 28·7 **19.** 65·8 **20.** 3·5 **21.** 51·1 **22.** 56·5

23. 6·5 **24.** 10·8 **25.** 9·2 **26.** 3·7 **27.** 40·8 **28.** $x = 16{\cdot}8$, $y = 11{\cdot}8$

29. $x = 16{\cdot}7$, $y = 33{\cdot}7$ **30.** 53·3 **31.** (a) 14·9 cm (b) 9·3 cm **32.** (a) 36° (b) 8·6 cm

33. (a) The ladder reaches 7·06 m up the wall, to the nearest centimetre.
(b) The horizontal distance from the foot of the ladder to the wall is 3·76 m, to nearest cm.

34. (a) The ladder makes and angle of 66° with the ground, to the nearest degree.
(b) The light is 4·6 metres above ground, correct to one decimal place.

35. The kite is 41 m above ground level, to the nearest metre.

36. (a) AB makes an angle of 22° with the horizontal, to the nearest degree.
(b) AB is of length 2·15 m, to the nearest centimetre.

37. To the nearest centimetre, AB = 12·45 m, BF = 9·53 m and FC = 12·45 m.
38. $\theta = 38{\cdot}7°$ correct to one decimal place.
The length of AD is 64% of the length of AE, to the nearest percent.
39. (a) Each short wire is of length 7·81 m (nearest cm) and makes an angle of 40° with the ground (nearest degree).
(b) Each long wire is of length 11·66 m (nearest cm) and makes an angle of 59° with the ground (nearest degree).
40. To the nearest centimetre, AC is of length 5·22 m, CG is of length 3·36 m, BH is of length 1·68 m, HC is of length 3·91 m.
41. To the nearest degree, each wire makes an angle of 62° with the horizontal.
42. (a) The largest possible length of the support wire EB is, to the nearest cm, 15·24 m.
(b) The shortest possible length of the support wire EB is, to the nearest cm, 12·56 m.
43. The bob rises 27 mm above its lowest position (to the nearest millimetre).
44. To the nearest metre point D is 10 metres above the horizontal ground.
45. The total length of steel required is 165 metres (to the nearest whole metre).
46. $x = 36{\cdot}7$, $y = 6{\cdot}1$

Exercise 10B. Page 177.

1. (a) 035° (or N35°E) (b) 080° (or N80°E) (c) 110° (or S70°E) (d) 145° (or S35°E)
(e) 200° (or S20°W) (f) 300° (or N60°W) (g) 215° (or S35°W) (h) 260° (or S80°W)
(i) 290° (or N70°W) (j) 325° (or N35°W) (k) 020° (or N20°E) (l) 120° (or S60°E)
2. (a) 30° (b) 20° (c) 35° (d) 15°
3. The height of the flagpole is 11·9 m, correct to one decimal place.
4. The angle of elevation of the sun is 26° (nearest degree).
5. The height of the flagpole is 10·0 m, correct to one decimal place.
6. Rounded up to the next metre the length is 19 metres.
7. To the nearest kilometre the ships are 10 km apart.
8. B is 66 m from A (to the nearest metre).
9. Ship C is approximately 26·9 km from ship A.
10. C is 216 m from A (to the nearest metre).
11. B is 91 m from A (to the nearest metre).
12. The height of the second tower is 65 metres, to the nearest metre.
13. The tree is approximately 14·8 metres tall.
14. The smoke is approximately 11·4 km from the first observation tower.
15. The ships are approximately 270 metres apart.
16. To the nearest metre the flagpole is 17 metres long.
17. The height of the flagpole is 15·5 metres, correct to one decimal place.
18. The required angle of elevation is 32° (nearest degree).

Miscellaneous Exercise Ten. Page 180.

1. (a) $x = 9{\cdot}4$ (b) $x = 18{\cdot}7$ (c) $x = 56{\cdot}3$ (d) $x = 4{\cdot}1$ (e) $x = 12{\cdot}1$ (f) $x = 66{\cdot}4$
2. The mean of the six amounts is \$26 350 and the median is \$14 100.
3. The mean for the girls was 21·2.
4. (a) $x = 21$ (b) $x = 2{\cdot}5$ (c) $x = 7$ (d) $x = 0{\cdot}625$
5. (a) $s = 3$ (b) $a = 4$
6. The number first thought of was 15.
7. John borrowed \$8 600.
8. (a)

24	12
29	5

(b)

29	14·5
36·5	7·5

(c)

184	92
269	85

(d)

34	17
44	10

(e)

36	18
47	11

(f)

14	7
14	0

(g)

44	22
59	15

(h)

60	30
83	23

9. (a) Approximately 27%.
(b) 37·9% of the income of the country is earned by the richest 10% of the population.
10. $y = 0{\cdot}5x + 2{\cdot}5$, $f = 7$, $g = -2$, $h = 13$, $i = -2$, $j = 4{\cdot}4$.
11. (a) 59% (b) More girls than boys.
12. A: $y = 5$ B: $x = -8$ C: $y = 2x - 4$ D: $y = -x + 5$ E: $y = 0{\cdot}2x$
F: $y = x - 9$ G: $y = 2x + 15$ H: $y = x - 12$ I: $y = 2x - 13$ J: $y = -\frac{1}{3}x - 8$
13. (a) 49 500 (b) 22 200 (c) 7·14 tonnes (to 2 d.p.)
14. $d = 11{\cdot}44$ m, $c = 2{\cdot}86$ m

Exercise 11A. Page 183.

1.	5·4, 27·2 cm^2	**2.**	45 cm^2	**3.**	27 cm^2	**4.**	20 cm^2	**5.**	9·6 cm^2
6.	211 m^2	**7.**	8·8 cm^2	**8.**	15·6 cm^2	**9.**	18·1 cm^2	**10.**	1730 mm^2

Exercise 11B. Page 188.

1.	13·9 cm^2	**2.**	75·8 cm^2	**3.**	18·8 cm^2	**4.**	101·8 cm^2	**5.**	87·3 cm^2
6.	3·8 cm^2	**7.**	32·5 cm^2	**8.**	23·0 cm^2	**9.**	11·8 cm^2	**10.**	17·3 cm^2
11.	10·4 cm^2	**12.**	6·8	**13.**	7·3	**14.**	6·6	**15.**	67°
16.	52°	**17.**	32°	**18.**	(a) \$125 000	(b)	\$51 000		

19. The second block has the greater area, by 9 m^2, to the nearest square metre.
20. The owner of block A receives \$472 193·55 and the owner of block B receives \$777 806·45.
21. AC needs to be 180 metres long, rounded up to the next whole metre.

Exercise 11C. Page 197.

1.	5·8	**2.**	6·6	**3.**	12·9
4.	54·8	**5.**	46·0	**6.**	54·2
7.	58 (nearest integer)	**8.**	12·3 (1 d.p.)	**9.**	54 (nearest integer)
10.	14 (nearest integer)	**11.**	105 (nearest integer)	**12.**	126 (nearest integer)
13.	6·7 (1 d.p.)	**14.**	75 (nearest integer)		

15. The pole is of length 614 cm, to the nearest centimetre.
16. The two shot journey is 38 metres further than the direct route, to the nearest metre.

17.	7·1	**18.**	1·7	**19.**	21·8
20.	73·0	**21.**	59 (nearest integer)	**22.**	14·4 (1 d.p.)
23.	43 (nearest integer)	**24.**	111 (nearest integer)	**25.**	44 (nearest integer)
26.	62 (nearest integer)	**27.**	11·9 (1 d.p.)	**28.**	146 (nearest integer)

29. The boat is then 13·4 km from its initial position, correct to one decimal place.
30. After eight seconds Jim and Toni are 10·7 metres apart, correct to one decimal place.
31. B is 13·1 km from C, correct to one decimal place.

32.	75 (nearest integer)	**33.**	99 (nearest integer)	**34.**	617 (nearest integer)
35.	5·39 (2 d.p.)	**36.**	135 (nearest integer)	**37.**	80 (nearest integer)
38.	160 (nearest integer)	**39.**	54 (nearest integer)		

40. The lengths of AC and BC are 672 cm and 824 cm respectively, each answer given to the nearest cm.
41. The smallest angle of the triangle is of size 42°, to the nearest degree.
42. The parallelogram has diagonals of length 5·1 cm and 9·7 cm, correct to one decimal place.
43. The parallelogram has sides of length 6·8 cm and 10·8 cm, correct to one decimal place.
44. (a) When AC is 2·6 metres $\angle CAB = 20°$, to the nearest degree.
(b) When AC is 2·1 metres $\angle CAB = 28°$, to the nearest degree.
45. (a) 479 cm (b) 239 cm (c) 111 cm (d) 222 cm
46. (a) At 5 o'clock the distance between the tip of the hour hand and the tip of the minute hand is 155 mm, to the nearest mm.
(b) At 10 minutes past 5 the distance between the tip of the hour hand and the tip of the minute hand is 119 mm, to the nearest mm.

47. (a) The ship is 1·77 km from the lighthouse, correct to 2 decimal places.
(b) The ship is 1·17 km from the coastal observation position, correct to 2 decimal places.
48. (a) Q is 18·5 km from P, correct to one decimal place.
(b) Q is 21·0 km from the lighthouse, correct to one decimal place.
49. Ship B is approximately 15·9 km from ship A, on a bearing 164°.
50. Twelve of the steel frameworks would require a total of 260 metres of steel (to the next 10 metres).
51. The block has an area of 5270 m^2 and a perimeter of 298 metres, both answers given to the nearest integer.
52. The triangular piece that has been removed has an area of 752 mm^2 and a perimeter of 128 mm, both answers given to the nearest whole number.
53. The block has an area of 6399 m^2, to the nearest square metre.

Miscellaneous Exercise Eleven. Page 203.

1. $y = 2x - 1$, B and E.
2. (a) $x = 17$ (b) $x = 7$ (c) $x = 2$ (d) $x = -2$ (e) $x = 35$ (f) $x = 20$
3. The estimated mean = 13·9. The median lies in the 11 → 15 interval.
4. The mean for the whole class of students is 23·8.
5. The number I first thought of was 17.
6. Four and a half years.
7. The flagpole is of height 13·7 metres, correct to one decimal place.
8. a = 6, b = 5, c = 19, d = 7, e = 3. 5, 7, 11, 13, 15, 21, 21, 25, 30, 31.
10. The boats are 7·4 km apart ninety minutes after leaving the harbour, to the nearest 100 m.
11. (a) 4 m (b) 3·46 m (c) 1 m (d) 1 m
12. The direct journey from A to C is 50·6 m shorter than the journey via B (correct to one dp).
13. Possibility 1 is of length 176 m, possibility 2 is of length 156 m and possibility 3 is of length 153 m (all to the nearest metre).
14. A mean number of nurses absent per day is 10·2, standard deviation 6·1.
They decide to have 14 in pool.
15. (a) The bottom bar covers fewer years (0 - 4) than the bar above it (5 - 14).
(b) Country A has more males than females for the age ranges 0 - 4, 5 - 14 and 35 - 44.
(c) Country B has more females than males for the age ranges 0 - 4, 15 - 24, 25 - 34, 35 - 44, and 45 - 54.
(d) Country B has approximately 4 800 000 people aged 55 and over.
(e) Discuss answer and reasons with your teacher.
16. For x from 0 to 2 : $y = 0{\cdot}2x$. For x from 2 to 3 : $y = 0{\cdot}1x + 0{\cdot}2$. For x from 3 to 4 : $y = 0{\cdot}5$.

Exercise 12A. Page 214.

1. $x = 1, y = 6$	**2.** $x = 3, y = -1$	**3.** $x = 4, y = 0$	**4.** $x = 5, y = -2$
5. $x = -3, y = 2$	**6.** $x = 7, y = 5$	**7.** $x = 3, y = 4$	**8.** $x = 3, y = -2$
9. $x = -7, y = 10$	**10.** $x = 9, y = 11$	**11.** $x = 5, y = -2$	**12.** $x = 4, y = 7$
13. $x = 4, y = 1$	**14.** $x = -3, y = 6$	**15.** $x = 4, y = 1$	**16.** $x = 4, y = -1$
17. $x = 4, y = 3$	**18.** $x = 3, y = 5$	**19.** $x = 7, y = 3$	**20.** $A = 5, B = -2$
21. $p = 5{\cdot}5, q = 3$	**22.** $x = 8, y = 15$	**23.** $x = 10, y = 10$	

24. (a) Equation 3: $x + y = 600$ (b) Equation 4: $x - y = 140$
(c) The baker baked 370 white loaves and 230 wholemeal loaves that day.
25. (a) Equation 1: $2x + 4y = 1758$ (b) Equation 5: $x - 5y = 403$
(c) Adding the number of people at the show to the number of dogs at the show gives total of 811.
26. (a) Equation 2: $y - x = 5$
(b) Equation 4: $2x + 3y = 70$
(c) The two numbers are 11 and 16.
27. (a) Equation 1: $x + y = 46$
(b) Equation 5: $x + 0{\cdot}5y = 32$
(c) The piggy bank contains 18 coins that are $1 coins and 28 that are 50 cent coins.

28. (a) Equation 3: $x + y = 23$
(b) Equation 6: $28x + 35y = 700$
(c) The seamstress bought 15 metres of material A and 8 metres of material B.

29. (a) Equation 3: $x + y = 25\,000$
(b) Equation 6: $0{\cdot}96x + 1{\cdot}12y = 25\,120$
(c) The investor put \$18 000 into company X and \$7 000 into company Y.

30. (a) Equation 1: $x + y = 35$
(b) Equation 5: $3y - 2x = 15$
(c) $x = 18$, $y = 17$. The area of the rectangle is 306 cm^2.

31. (a) Equation 3: $16x + 7y = 256$
(b) Equation 6: $20x + 11y = 338$
(c) For five adults and three children the cost would be \$86·50.

32. The equations are $x + y = 41$ and $3y + 2x = 106$.
The two numbers are 17 and 24.

33. The two numbers are 13 and 24.

34. The chemist should use 80 mL from bottle A and 20 mL from bottle B.

35. (a) $x + y = 12\,000$, $1{\cdot}12x + 1{\cdot}05y = 13\,195$ (b) $x = 8\,500$, $y = 3\,500$

36. 450 tickets were sold for \$12 each and 1 050 were sold for \$8 each.

37. The company has 16 of the 56 seaters and 9 of the 35 seaters.

38. The two numbers are 7 and 16.

39. They sold 46 jars of jam and 32 jars of relish.

40. \$75 000 was borrowed at 14% and \$45 000 was borrowed at 17%.

41. David answered 19 correctly.
At least 18 questions must be correctly answered for a mark of at least 50.

Miscellaneous Exercise Twelve. Page 219.

1. (a)
- $74 - 70 \cos x$ does not equal $4 \cos x$. Rule of order not being followed.
- If $16 = 4 \cos x$, $\cos x = 4$ not 0·25.
- Inappropriate degree of accuracy in final answer for accuracy of given data.

(b)
- Not correct to use $A = 0{\cdot}5ab\sin C$ for given information as the angle of known size is not between the two sides of known length.
- $\frac{76 \times 72 \times \sin 64°}{2}$ does not equal $38 \times 36 \times \sin 32°$. Could write it as $38 \times 72 \times \sin 64°$ or as $76 \times 36 \times \sin 64°$ but not what is written in given "solution".
- Final answer claims to be an area but has units of length.

(c)
- Given working involves the sine rule not the cosine rule as claimed.
- Rearrangement should give $\sin \angle BCA = \frac{6{\cdot}8 \sin 65°}{7{\cdot}1}$, not what is claimed.
- Obtuse angle should not be claimed as being a solution because $\angle BCA$ is not opposite longest side and so cannot be obtuse.

(d)
- Should be taking away $2 \times 5 \times 7 \cos 130°$ not adding it on.
- $74 + 70 \cos 130°$ does not equal $144 \cos 130°$. Rule of order not being followed.
- $144 \cos 130°$ gives a negative value for x^2, not a positive value. A negative value would then mean that x could not be determined.
- Given value for x includes units but x is a number not a length.

2. (a) Nominal categorical (b) Continuous numerical
(c) Ordinal categorical (d) Discrete numerical
(e) Continuous numerical (f) Continuous numerical
(g) Discrete numerical (h) Nominal categorical
(i) Nominal categorical (j) Discrete numerical

3. (a) $x = 6, y = 5$ (b) $x = 3, y = 2$ (c) $x = 2, y = 3$

4. (a) $x = 3{\cdot}6$ (b) $x = 7$ (c) $x = 15$ (d) $x = 11, y = 3$ (e) $x = 3{\cdot}5$ (f) $x = 14$

5. A: $y = -x + 60$ B: $y = 60$ C: $y = 2x - 60$ D: $x = 60$ E: $y = -2x + 30$ F: $y = 0{\cdot}5x + 30$

6. The direct journey from A to C is 647 m shorter than the journey via B, to the nearest metre.
7. The graphs of all members of the family will have a gradient of 3.
8. The graphs of all members of the family will pass through the point (0, –7).
9. The graphs of all members of the family will have a gradient of –0·5.
10. The fire is approximately 19·7 km from lookout N^{o}·1 and 18·8 km from lookout N^{o}·2.
11. 0·285 km, i.e. approximately 300 metres.
12. (a) The steeper the line the greater the speed. Hence we can see from the graph that the third stage was the one with the greater average speed.
(b) 1st stage: 20 km/h. 2nd stage: 15 km/h. 3rd stage: 25 km/h.
(c) From town A to town B the delivery van averaged 60 km/h.
(d) From town B to town A the delivery van averaged 80 km/h
(e) The delivery van would need to average more than 120 km/h to arrive back at A before the cyclist got there!
13. $34 000 secure, $16 000 risky **14.** $15 600 secure, $40 000 risky
15. Answers not given here. Check that your part (b) and (c) answers are the same.
16. (a) (i) The statement is incorrect. There are the same number of results to the right of the median as there are to the left of the median.
(ii) The box plots do not tell us how many students were involved. Hence we cannot conclude that there were more 14 year olds than 12 year olds.
(iii) The word "much" is open to interpretation. Better to quantify rather than use words like "much". The reader can then decide if they wish to interpret the difference as "much". Instead could say, for example: The interquartile range for the 14 year olds was 7 seconds which exceeded that of the 12 year olds which was 6 seconds.
(b) Discuss the reasonableness of your statements with others in your class.

Exercise 13A. Page 224.

1. (a) 1 (b) 1·7 (c) –2 (d) 0·5 (e) –0·75
2. Test A: 2·5, Test B: –1, Test C: 1·25, Test D: 0·2
3. Computing (1·216), Chemistry (0·278), Mathematics (–0·385), Electronics (–0·616)
4. English, Mathematics, Science, Social Studies.
5. Jill: *"Well I got 1."* Jill: *"The mean was zero."* Jill: *"Oh he got –0·25."*

Exercise 13C. Page 233.

1. 0·2266 **2.** 0·6377 **3.** 54·56
4. (a) 0·5828 (b) –0·6433 (c) 1·2265 (d) –0·7388
5. (a) 19·5 (b) 21·9 (c) 18·7 (d) 23·1
6. (a) 0·68 (b) 0·95 (c) 0·997 (d) 0·95 (e) 0·997
(f) 0·34 (g) 0·84 (h) 0·16 (i) 0·84 (j) 0·16
7. (a) 99·7% (b) 16% (c) 13·5%
8. (a) 16% (b) 2·5%
9. (a) 0·3085 (b) 0·0062
10. (a) 0·5 (b) 0·34
11. (a) 0·3085 (b) 0·2902 (c) 0·0228
12. (a) approx 11 (b) approx 11 (c) approx 39
13. 0·0548
14. (a) 415 (b) 217
15. To nearest 0·5 cm: 158·5 cm, 191·5 cm
16. A/B: 78, B/C: 68, C/D: 55, D/F: 47
17. (a) 0·1587 (b) 7.38 am (c) 7.33 am
18. (a) 2 yrs (b) 7 yrs (c) 91 yrs (d) 0·783
19. (a) approx 40 (b) 0·236

Miscellaneous Exercise Thirteen. Page 237.

1. (a) Eq^{n} 3: $4 = 3m + c$ (b) Eq^{n} 5: $19 = 8m + c$ (c) The straight line eq^{n} is $y = 3x - 5$.
2. mean 24·08, median 24, mode 20, range 29.
3. Four hot dogs and six burgers would cost a total of $32·20.
4. $x = 16, y = 5$. The rectangle has an area of 80 cm^2.
5. Each mixed bag should contain 8 chocolates and 12 lollies.
6. (a) The cost of constructing 25 km of similar highway would be 155 million dollars.
(b) The cost of constructing 52 km of similar highway would be 317 million dollars.

7. (a) 167, 168, 169 (b) 166, 168, 170

8. 337°, 3·4 km

9. The topmost point is 35 metres above ground (to the nearest metre).

10. (a) Revenue is likely to be zero for zero units sold. Thus line I is likely to be revenue line. Costs are likely to have some fixed costs for "set up" then an amount per unit made. Thus line II is likely to be cost line.

(b) Break even when $x = 40$ (then Cost = Revenue = \$3200).

(c) I: $R = 80x$ II: $C = 2000 + 30x$

11. The yacht travelled 918 metres, to the nearest metre

12. If the agent attempts to calculate a mean he will have to decide what values to assume for the one property "\$400 000 or less" and the six that are "over \$1 000 000". Hence determining the mean presents a problem. Using the modal class will not be an indicator of *central* tendency. The median is probably the most suitable to work with. The median will be the 15th sale price and will lie in the \$700 001 → \$800 000 interval. The 15th will be the "last" value in this class so he could suggest a value in this interval but towards the \$800 000 end. Hence a reasonable average for the given data could be about \$780 000.

In reality a lot may depend on what he wants the average for. If a customer is asking it may be more informative to show the customer the whole table as this shows the quite considerable range of prices. Just knowing an average may not be that helpful. If the average is really needed perhaps the agent should attempt to find out the actual sale prices of the 29 properties. Just how recent the sales were made could also be an important consideration.

13. (a) The total length of aluminium is 775 cm, to the nearest centimetre.

(b) The area of glass is 19 580 cm^2, to the nearest 10 square centimetres.

14. The distance between the hands is 471 mm, to the nearest millimetre.

15.

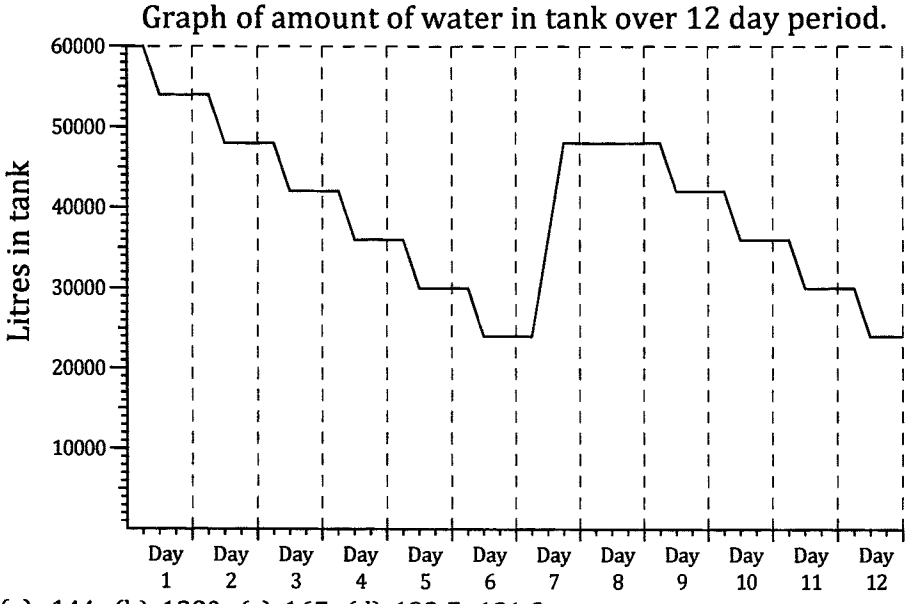
Initials	PA	CB	JB	CC	JD	KD	LF	LJ	MJ	EK	IM	PN
Grade	C	D	A	D	B	C	F	C	B	C	B	C

Initials	RN	PP	AR	TR	VR	AS	PS	TS	BV	PV	IW	RZ
grade	D	B	D	C	B	C	C	C	D	B	F	C

16. (a) 41 m (nearest metre) (b) 26 m (nearest metre)

(c) 49 m (nearest metre) (d) 328° (nearest degree)

17.



18. (a) 144 (b) 1280 (c) 167 (d) 122·7, 131·3

19. (a) ~32·5 m (b) ~61 m