14 A survey is made of the investments of the members of a club. All of the 133 members own at least one type of share; 96 own mining shares, 70 own oil shares, and 66 members own industrial shares. Of those who own mining shares, 40 also own oil shares and 45 also own industrial shares. The number who own both oil shares and industrial shares is 28. How many members of the club own all three types of share?

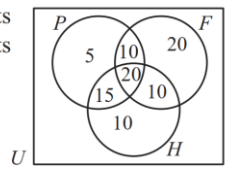
15 At a certain school there are 90 students studying for their matriculation certificate. They are required to study at least one of the subjects: Physics, French or History. Of these students, 50 are studying Physics, 60 are studying French, and 55 are studying History. Thirty students are studying both Physics and French, while 10 students are studying both French and History but not Physics. Twenty students are studying all three subjects.
Construct and explain a Venn diagram which represents this situation.
Use this diagram to determine:

a how many students are studying both Physics and History, but not French

b how many students are studying at least two of these three subjects.

11 11 violin players
12 19 places
13 43%
14 14 members

15 **a** 15 students
b 55 students



2 Express with integer denominator:

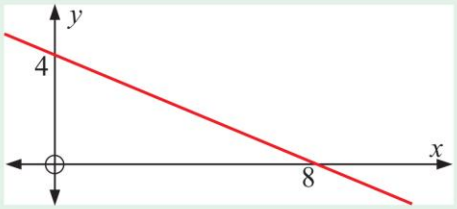
a $\dfrac{1}{3-\sqrt{5}}$ **b** $\dfrac{1}{2+\sqrt{3}}$ **c** $\dfrac{1}{4-\sqrt{11}}$ **d** $\dfrac{\sqrt{2}}{5+\sqrt{2}}$

e $\dfrac{\sqrt{3}}{3+\sqrt{3}}$ **f** $\dfrac{5}{2-3\sqrt{2}}$ **g** $\dfrac{-\sqrt{5}}{3+2\sqrt{5}}$ **h** $\dfrac{3-\sqrt{7}}{2+\sqrt{7}}$

2 **a** $\dfrac{3+\sqrt{5}}{4}$ **b** $2-\sqrt{3}$ **c** $\dfrac{4+\sqrt{11}}{5}$ **d** $\dfrac{5\sqrt{2}-2}{23}$

e $\dfrac{\sqrt{3}-1}{2}$ **f** $\dfrac{10+15\sqrt{2}}{-14}$ **g** $\dfrac{3\sqrt{5}-10}{11}$ **h** $\dfrac{5\sqrt{7}-13}{3}$

3 Determine the equation of the illustrated line:



4 Find the equation of the line through $(1, -2)$ and $(3, 4)$.

5 Show that $A(1, -2)$, $B(4, 4)$ and $C(5, 6)$ are collinear.

6 Find b given that $A(-6, 2)$, $B(b, 0)$ and $C(3, -4)$ are collinear.

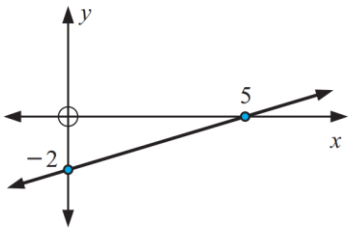
7 Find the axes intercepts for the line with equation $2x - 5y = 10$, and hence draw a graph of this line.

2 $a = -2 \pm 2\sqrt{5}$ **3** $y = -\frac{1}{2}x + 4$ **4** $3x - y = 5$

5 gradient of [AB] = gradient of [BC] $= 2$ and B is common

6 $b = -3$

7 $2x - 5y = 10$



5 Find the equation of the line:

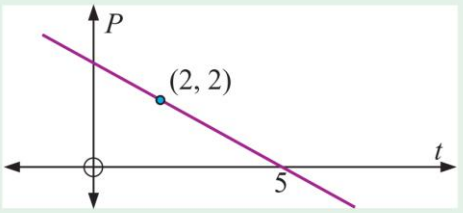
a with gradient -2 and y-intercept 7

b passing through $(-1, 3)$ and $(2, 1)$

c parallel to a line with gradient $\frac{3}{2}$ and passing through $(5, 0)$.

6 If $(k, 5)$ lies on the line with equation $3x - y = -8$, find k.

7 Find the equation connecting the variables for the graph given.

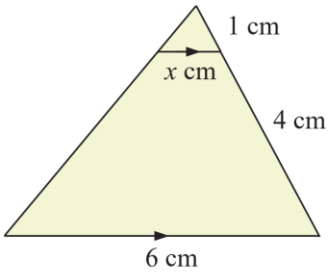


5 **a** $y = -2x + 7$ **b** $2x + 3y = 7$ **c** $3x - 2y = 15$

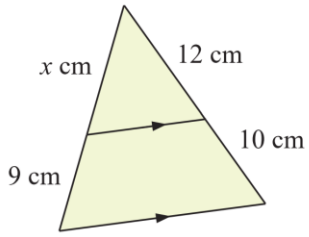
6 $k = -1$ **7** $2t + 3P = 10$

2 For the following figures, establish that a pair of triangles is similar, and hence find x:

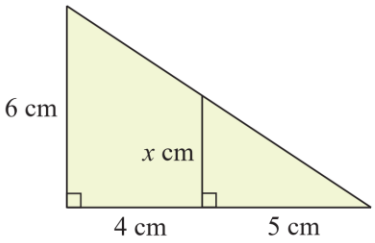
a



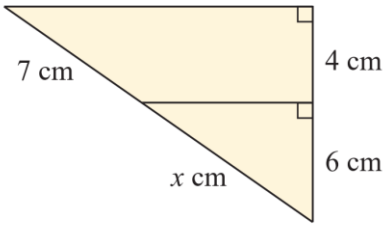
b



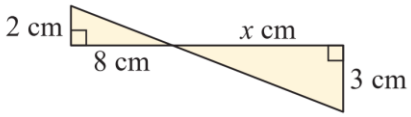
c



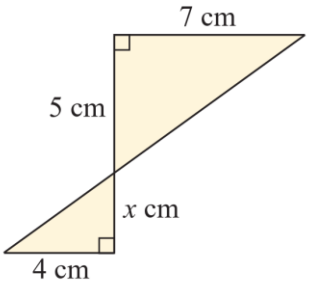
d



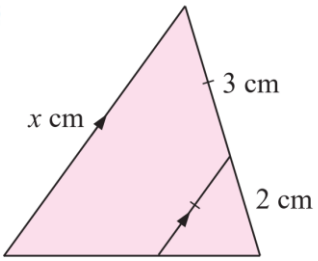
e



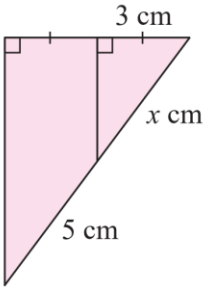
f



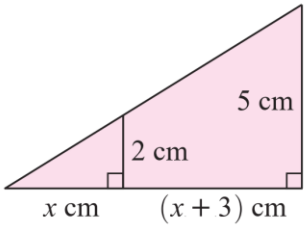
g



h



i



2 **a** $x = 1.2$ **b** $x = 10.8$ **c** $x = 3\frac{1}{3}$ **d** $x = 10.5$
e $x = 12$ **f** $x = 2\frac{6}{7}$ **g** $x = 7.5$ **h** $x = 5$ **i** $x = 6$

2 The following data shows the lengths, in centimetres, of 40 salmon caught in a lake during a fishing competition.

30 26 38 28 27 31 38 34 40 24 33 30 36 38 32 35 32 36 27 35
36 37 29 31 33 40 34 37 44 38 36 34 33 31 38 35 36 33 33 28

a Construct a cumulative frequency table for salmon lengths, x cm, using the intervals: $24 \leqslant x < 27$, $27 \leqslant x < 30$, ... etc.

b Draw a cumulative frequency graph.

c Use **b** to find the median length.

d Use the original data to find its median and compare your answer with **c**. Comment!

3 In an examination the following scores were achieved by a group of students:

Draw a cumulative frequency graph of the data and use it to find:

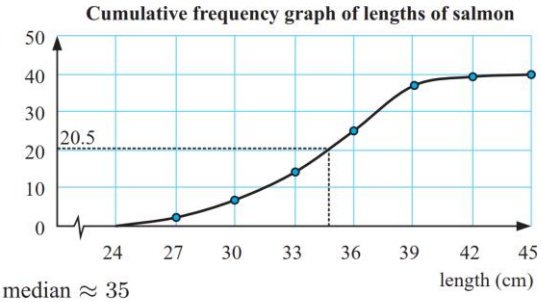
- **a** the median examination mark
- **b** how many students scored less than 75 marks
- **c** how many students scored between 60 and 80 marks
- **d** how many students failed, given that the pass mark was 55
- **e** the credit mark, given that the top 16% of students were awarded credits.

Score	*Frequency*
$10 \leqslant x < 20$	2
$20 \leqslant x < 30$	6
$30 \leqslant x < 40$	4
$40 \leqslant x < 50$	8
$50 \leqslant x < 60$	12
$60 \leqslant x < 70$	27
$70 \leqslant x < 80$	34
$80 \leqslant x < 90$	18
$90 \leqslant x < 100$	9

2 **a**

Salmon lengths (cm)	*Freq.*	*Cum. Freq.*
$24 \leqslant x < 27$	2	2
$27 \leqslant x < 30$	5	7
$30 \leqslant x < 33$	7	14
$33 \leqslant x < 36$	11	25
$36 \leqslant x < 39$	12	37
$39 \leqslant x < 42$	2	39
$42 \leqslant x < 45$	1	40

b

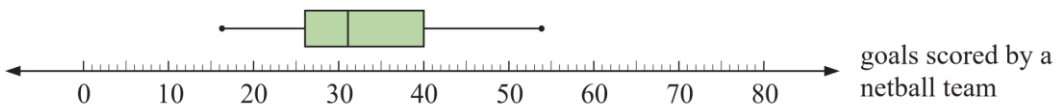


c median $\approx$ 35

d Median is 34. The graph is assuming a constant change over the interval whereas original data is not uniform over the interval.

3 **a** 70 **b** 76 **c** 61 **d** 26 **e** 84

1



a The boxplot given summarises the goals scored by a netball team. Locate:

i the median **ii** the maximum value **iii** the minimum value

iv the upper quartile **v** the lower quartile.

b Calculate: **i** the range **ii** the interquartile range.

1 **a** **i** 31 **ii** 54 **iii** 16 **iv** 40 **v** 26

b **i** 38 **ii** 14

6 The given table shows the distribution of scores for a year 10 spelling test in Australia.

Score	*Frequency*
6	2
7	4
8	7
9	12
10	5
Total	30

a Calculate the:

i mean **ii** mode

iii median **iv** range of the scores

b The average score for all year 10 students across Australia in this spelling test was 6.2. How does this class compare to the national average?

c Describe the skewness of the data set.

6 **a** **i** 8.47 **ii** 9 **iii** 9 **iv** 4 **b** well above average
c negatively skewed

4 Find the equation of the line:

a which has gradient $\frac{1}{2}$ and cuts the y-axis at 3

b which is parallel to a line with slope 2, and passes through the point $(-1, 4)$

c which cuts the x-axis at 5 and the y-axis at -2

d which cuts the x axis at -1, and passes through $(-3, 4)$

e which is perpendicular to a line with gradient $\frac{3}{4}$, and cuts the x-axis at 5

f which is perpendicular to a line with gradient -2, and passes through $(-2, 3)$.

5 Find the gradient of the line with equation:

a $y = 3x + 5$ **b** $y = 1 - 2x$ **c** $y = 0$

d $x = 2$ **e** $y = \dfrac{2x - 5}{3}$ **f** $3x + y = 4$

g $2x - 7y = 3$ **h** $2x + 7y = 4$ **i** $3x - 4y = 1$

j $3x + 4y = 7$ **k** $Ax - By = C$ **l** $Ax + By = C$

4 **a** $y = \frac{1}{2}x + 3$ **b** $y = 2x + 6$ **c** $2x - 5y = 10$

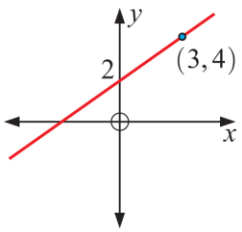
d $y = -2x - 2$ **e** $4x + 3y = 20$ **f** $x - 2y = -8$

5 **a** 3 **b** -2 **c** 0 **d** undefined **e** $\frac{2}{3}$ **f** -3 **g** $\frac{2}{7}$

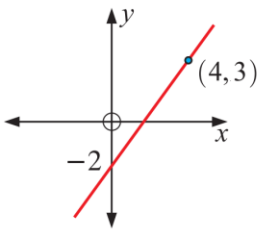
h $-\frac{2}{7}$ **i** $\frac{3}{4}$ **j** $-\frac{3}{4}$ **k** $\dfrac{A}{B}$ **l** $-\dfrac{A}{B}$

2 Find the equations of the illustrated lines:

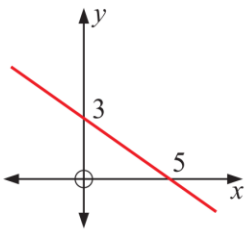
a



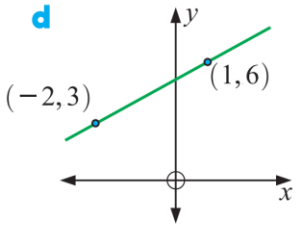
b



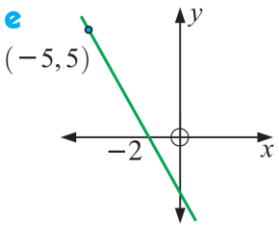
c



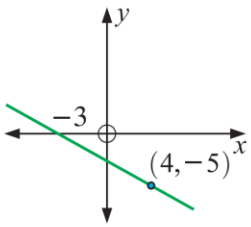
d



e



f



2 **a** $y = \frac{2}{3}x + 2$ **b** $y = \frac{5}{4}x - 2$ **c** $y = -\frac{3}{5}x + 3$
d $x - y = -5$ **e** $5x + 3y = -10$ **f** $5x + 7y = -15$

4 Find the equation of the line which is:

a parallel to the line $3x + 4y = 6$ and passes through (2, 1)

b perpendicular to the line $5x + 2y = 10$ and passes through $(-1, -1)$

c perpendicular to the line $x - 3y + 6 = 0$ and passes through $(-4, 0)$

d parallel to the line $x - 3y = 11$ and passes through (0, 0).

4 **a** $3x + 4y = 10$ **b** $2x - 5y = 3$
c $3x + y = -12$ **d** $x - 3y = 0$

1 Find the equation of the perpendicular bisector of [AB] for:

a A(3, −3) and B(1, −1) **b** A(1, 3) and B(−3, 5)

c A(3, 1) and B(−3, 6) **d** A(4, −2) and B(4, 4).

1 **a** $x - y = 4$ **b** $2x - y = -6$
c $12x - 10y = -35$ **d** $y = 1$