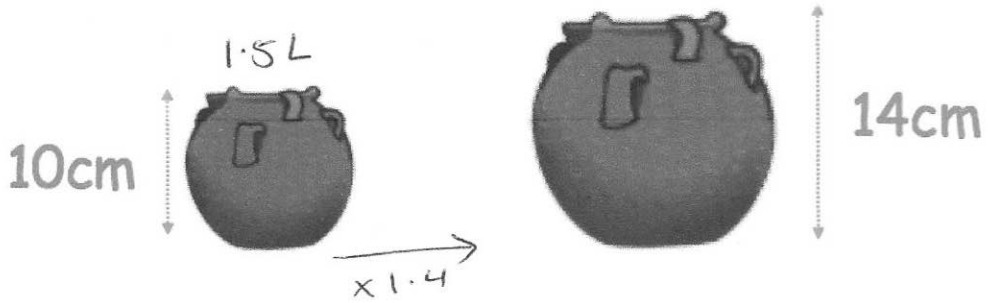
32. Mrs Hampton is potting plants.
She is using two mathematically similar pots, the smaller is 10cm tall and the larger 14cm tall.

She has two bags of soil, each containing 30 litres of soil.

With the first bag, Mrs Hampton fills 20 small pots using all of the soil in the bag.



How many large pots can be filled completely using the second bag of soil?

$30 \div 20 = 1.5$ litres

$1.5 \times 1.4^3 = 4.116$ litres

$30 \div 4.116 = 7.28\ldots$

7

(5)

33. Declan ran a distance of 200m in a time of 26.2 seconds.

The distance of 200m was measured to the nearest 10 metres.
The time of 26.2 was measured to the nearest tenth of a second.

Work out the upper bound for Declan's average speed.

$S = \frac{d}{t}$

$\text{max } S = \frac{\text{max } d}{\text{min } t} = \frac{205}{26.15}$

7.839 .....m/s

(2)

34. (a) Solve $y^2 + 9y + 2 = 8y + 58$

$y^2 + y - 56 = 0$

$(y+8)(y-7) = 0$

$y = -8$ or $y = 7$

$y = -8$ or $y = 7$

(2)

(b) Solve $5x^2 + 19x - 4 = 0$

$(5x - 1)(x + 4) = 0$

$5x = 1$ or $x = -4$

$x = \frac{1}{5}$

$x = \frac{1}{5}$ or $x = -4$

(2)

35 . Solve the equation $x^2 - 2x - 9 = 0$

Give your answers to two decimal places.

$a = 1$

$b = -2$

$c = -9$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{2 \pm \sqrt{(-2)^2 - 4(1)(-9)}}{2 \times 1}$$

$$x = \frac{2 \pm \sqrt{40}}{2}$$

x = 4.16 or x = -2.16

(3)

36. The *n*th term of a sequence is 4n - 7

(a) Write down the first three terms of the sequence.

1st term ...-3..., 2nd term ...1..., 3rd term ...5...

(2)

(b) What is the difference between the 150th and 151st terms?

...4...

(1)

The last term of this sequence is 393.

(c) How many terms are there in this sequence?

$4n - 7 = 393$

$4n = 400$

$n = 100$

...100...

(2)

37. Here are the first 5 terms of a quadratic sequence

9 17 29 45 65

Find an expression, in terms of n, for the nth term of this quadratic sequence.

$a+b+c$ 9 17 29 45 65

8 12 16 20

$3a+b$ 4 4 4

$2a$

$2a=4$
$a=2$

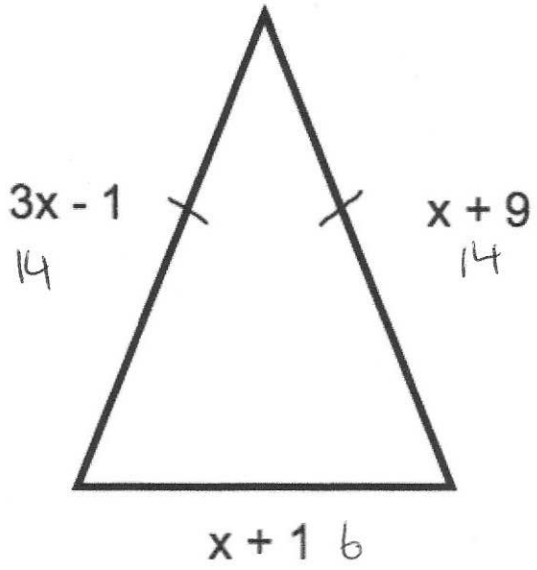
$3a+b=8$
$3(2)+b=8$
$b=2$

$a+b+c=9$
$2+2+c=9$
$c=5$

$2n^2+2n+5$

(3)

38 . Shown below is an isosceles triangle. Each side is measured in centimetres.



Find the perimeter of the triangle

$3x - 1 = x + 9$

$2x = 10$

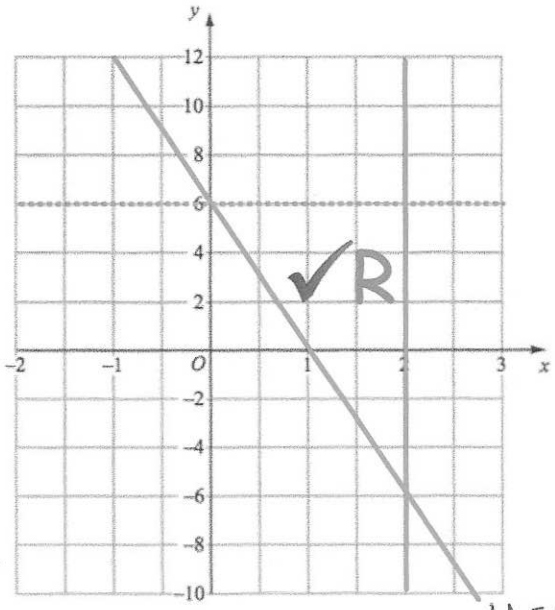
$x = 5$

$14 + 14 + 6 = 34$

34cm

(4)

39.



$y = -6x + 6$

The region labelled R satisfies three inequalities.

$0 > -6$

State the three inequalities

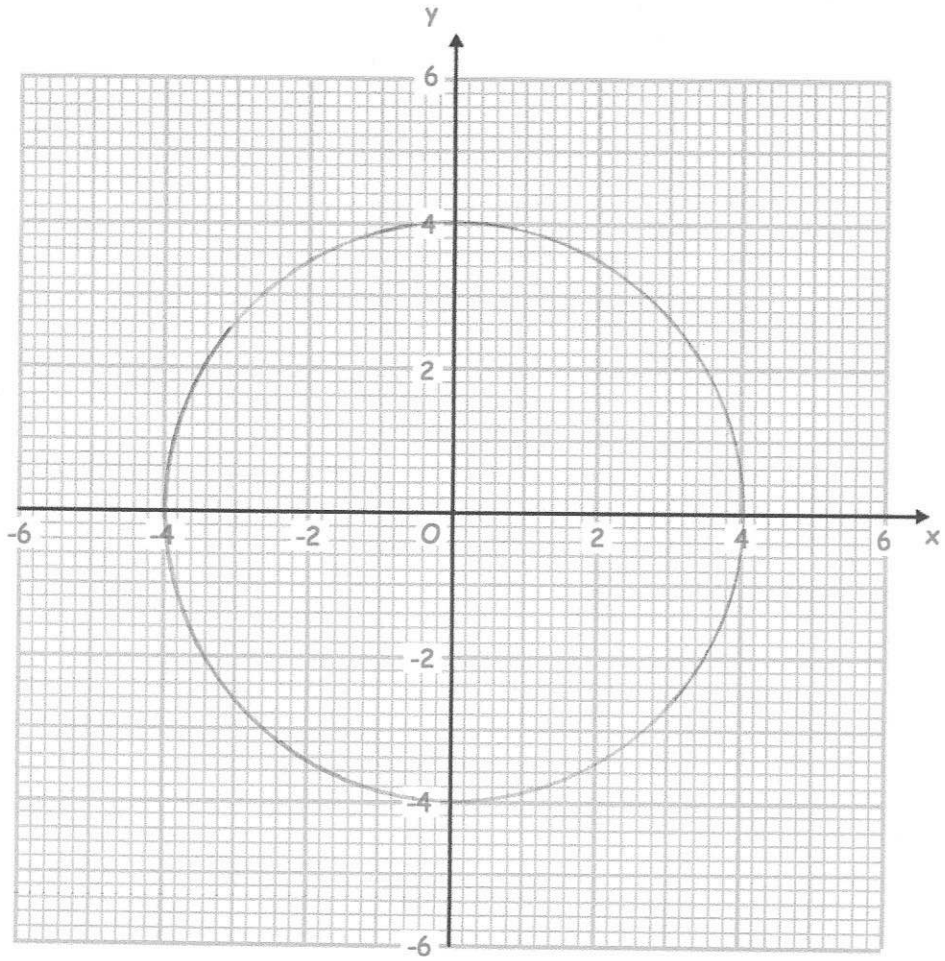
$y < 6$

$x \leq 2$

$y \geq -6x + 6$

(3)

40. Draw the circle with equation $x^2 + y^2 = 16$



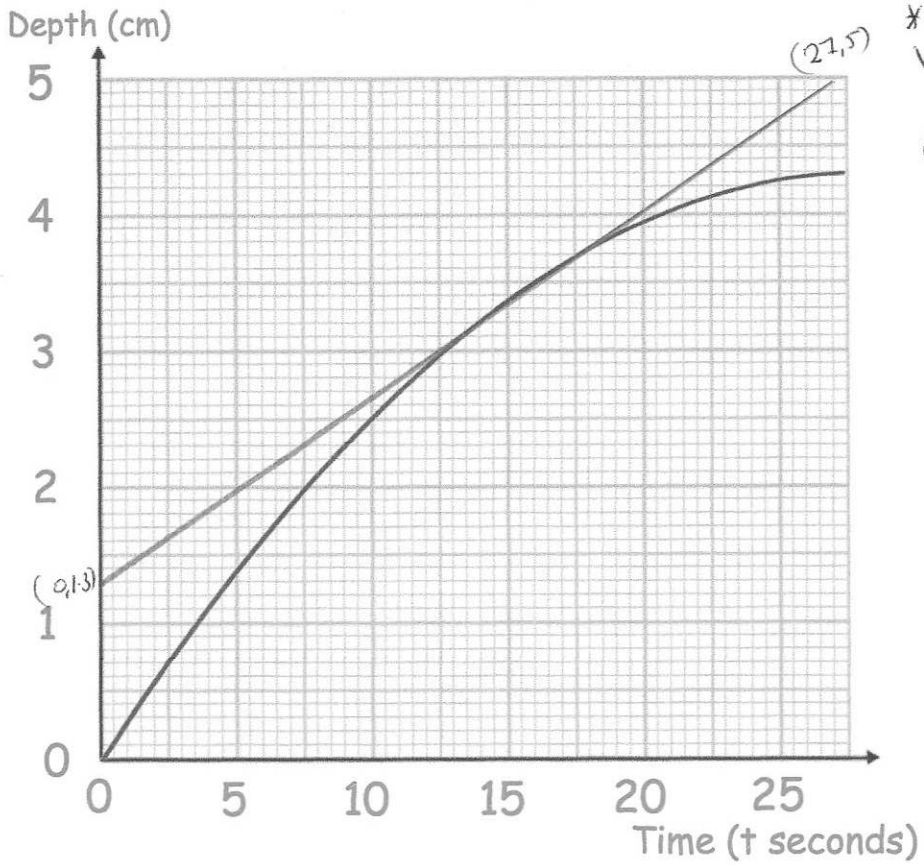
$\sqrt{16} = 4$

$r = 4$

(2)

41 . Jack is filling a container with water.

The graph shows the depth of the water, in centimetres, t seconds after the start of filling the container.



*Answers may vary due to individual tangents

(a) Calculate an estimate for the gradient of the graph when t = 15 seconds.

$\frac{\text{Rise}}{\text{Run}} = \frac{3.7}{27}$

0·137

(3)

(b) Describe fully what your answer to (a) represents

It is the rate at which the depth of water in the container is increasing 0·137 cm per second

(2)

(c) Explain why your answer to (a) is only an estimate

It is only a hand drawn tangent - it may not be precise

(1)

42

(a) Show that the equation $x^3 + 2x = 1$ has a solution between x = 0 and x = 1

$x^3 + 2x - 1 = 0$

when $x = 0$ $\quad 0^3 + 2(0) - 1 = -1$

$x = 1$ $\quad 1^3 + 2(1) - 1 = 2$

Since there is a change in sign between $x = 0$ $x = 1$ there is a solution.

(2)

(b) Show that the equation $x^3 + 2x = 1$ can be rearranged to give $x = \frac{1}{2} - \frac{x^3}{2}$

$2x = 1 - x^3$

$x = \frac{1}{2} - \frac{x^3}{2}$

(1)

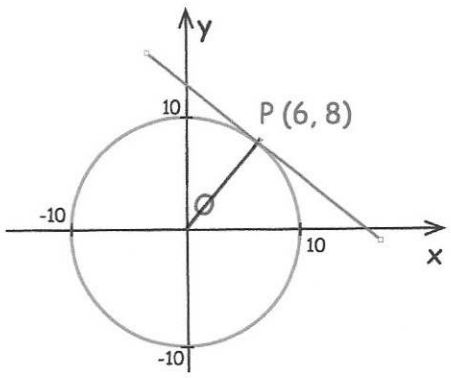
(c) Starting with $x_0 = 0$, use the iteration formula $x_{n+1} = \frac{1}{2} - \frac{x_n^3}{2}$ twice to find an estimate for the solution of $x^3 + 2x = 1$

$x_1 = \frac{1}{2} - \frac{0^3}{2} = 0.5$

$x_2 = \frac{1}{2} - \frac{0.5^3}{2} = 0.4375$

(3)

43. Here is a circle, centre O, and the tangent to the circle at the point (6, 8).



Find the equation of the tangent at the point P.

gradient of OP $= \frac{4}{3}$

$y = \frac{-3}{4}x + c$

$8 = -4 \cdot 5 + c$

$c = 12 \cdot 5$

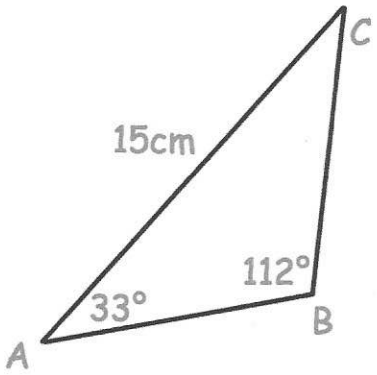
$y = \frac{-3}{4}x + 25/2$

(4)

or

$y = -0 \cdot 75x + 12 \cdot 5$

44. (a)

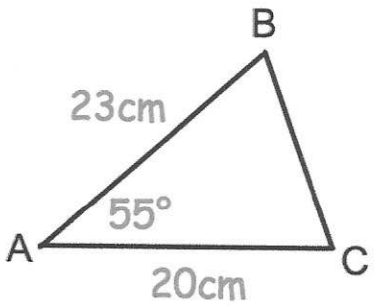


In triangle ABC the length of AC is 15cm.
Angle ABC = 112°
Angle BAC = 33°

Work out the length of BC. $\frac{x}{\sin 33} = \frac{15}{\sin 112}$

.....8.81.....cm
(3)

(b)



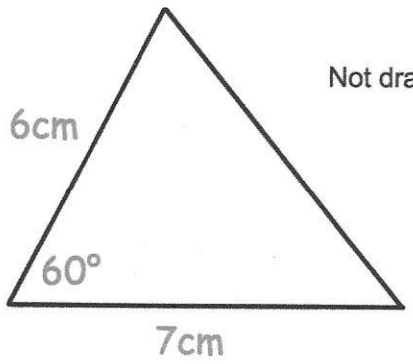
Calculate the length of BC.

$x^2 = 23^2 + 20^2 - 2(20)(23)\cos 55$

$x^2 = 401.3...$

.....20.03.....cm
(3)

45



Not drawn is scale.

Calculate the area of the triangle.

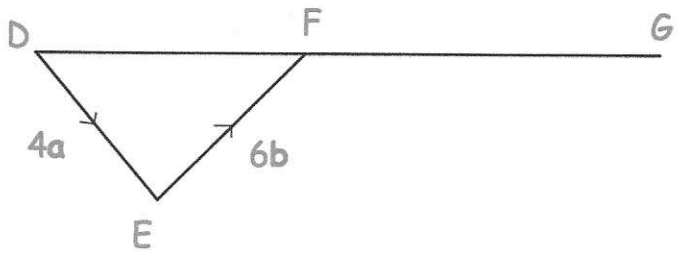
$\frac{1}{2}(6)(7)\sin 60$

.....18.19..... cm^2

(2)

46. DFG is a straight line.

$\overrightarrow{DE} = 4\mathbf{a}$ and $\overrightarrow{EF} = 6\mathbf{b}$



(a) Write down the vector $\overrightarrow{DF}$ in terms of **a** and **b**

$4\underline{a} + 6\underline{b}$

(1)

(b) DF : FG = 2:3

Work out the vector $\overrightarrow{DG}$ in terms of **a** and **b**
Give your answer in its simplest form.

$(4\underline{a} + 6\underline{b}) \div 2 = 2\underline{a} + 3\underline{b}$

$(2\underline{a} + 3\underline{b}) \times 5$

$10\underline{a} + 15\underline{b}$

(2)

47. There are 8 sweets in a bag.
Three sweets are red, three sweets are blue and two sweets are green.

Three sweets are selected at random **without** replacement.

Calculate the probability that the sweets are **not** all the same colour.

$P(RRR) = \frac{3}{8} \times \frac{2}{7} \times \frac{1}{6} = \frac{1}{56}$

$P(BBB) = \frac{1}{56}$

Not same

$1 - \frac{2}{56} = \frac{54}{56}$

27/28

(4)

48. Solve the simultaneous equations

$2x + y = 5$
$2x^2 + y^2 = 1148$

$y = 5 - 2x$

$2x^2 + (5-2x)(5-2x) = 11$

$2x^2 + (25 - 20x + 4x^2) = 11$

$6x^2 - 20x + 14 = 0$

$3x^2 - 10x + 7 = 0$

$(x-1)(3x-7) = 0$

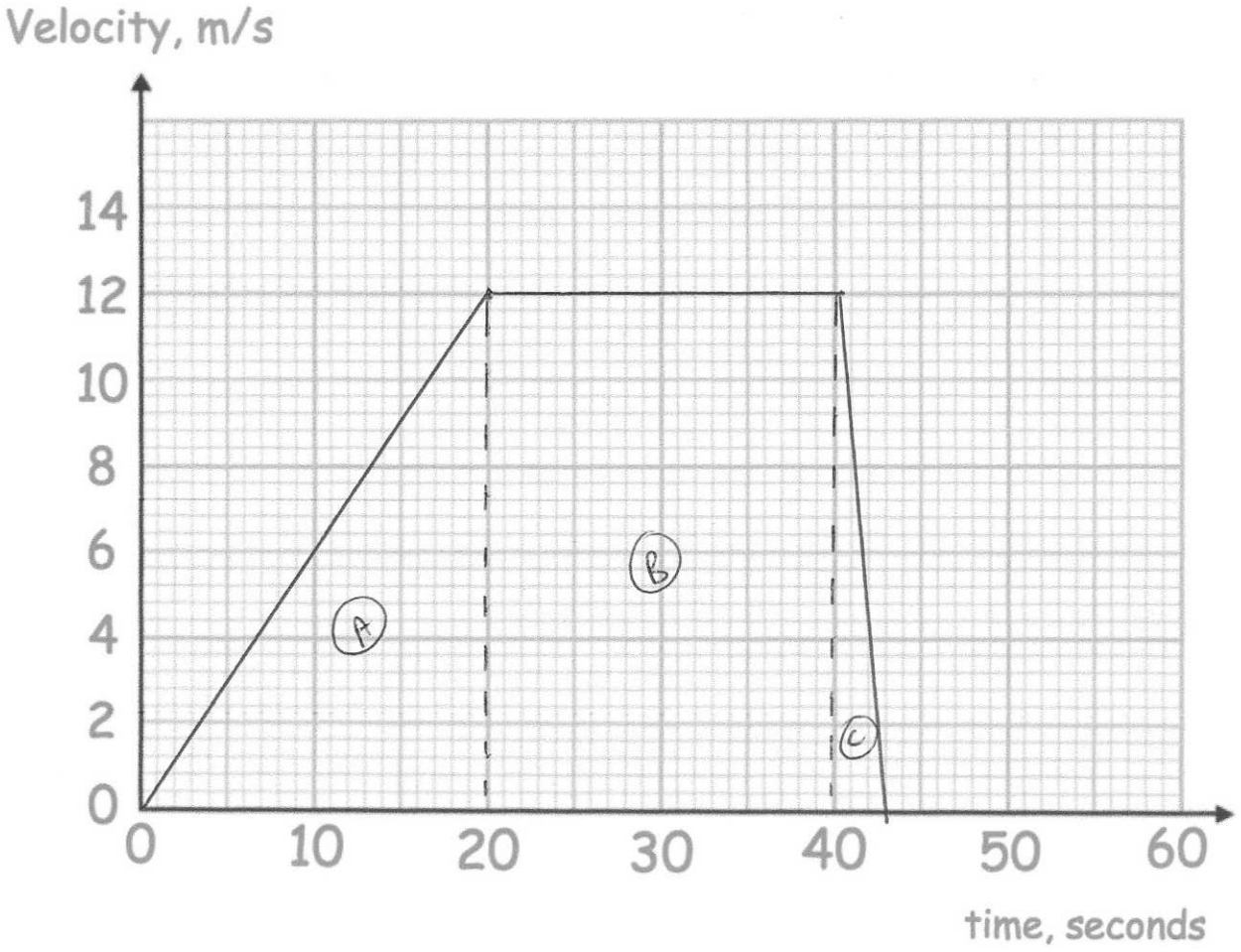
$x = 1$ or $x = 7/3$

$y = 3$ or $y = 1/3$

$x = 1, y = 3$ or $x = 7/3, y = 1/3$

49. A remote control car drives in a straight line.
It starts from rest and travels with constant acceleration for 20 seconds reaching a velocity of 12m/s.
It then travels at a constant speed for 20 seconds.
It then slows down with constant deceleration of $4m/s^2$.

(a) Draw a velocity time graph



(b) Using your velocity-time graph, work out the total distance travelled.

$A = \frac{1}{2}(20)(12) = 120$

$B = 20 \times 12 = 240$

$C = \frac{1}{2}(3)(12) = 18$

378 m

(2)

50. A supermarket sells Baked Beans in two different size cans.

215g

40p

395g

74p

Which size can is the best value for money?
You must show all your working.

$40 \div 215 = 0.186$p per gram

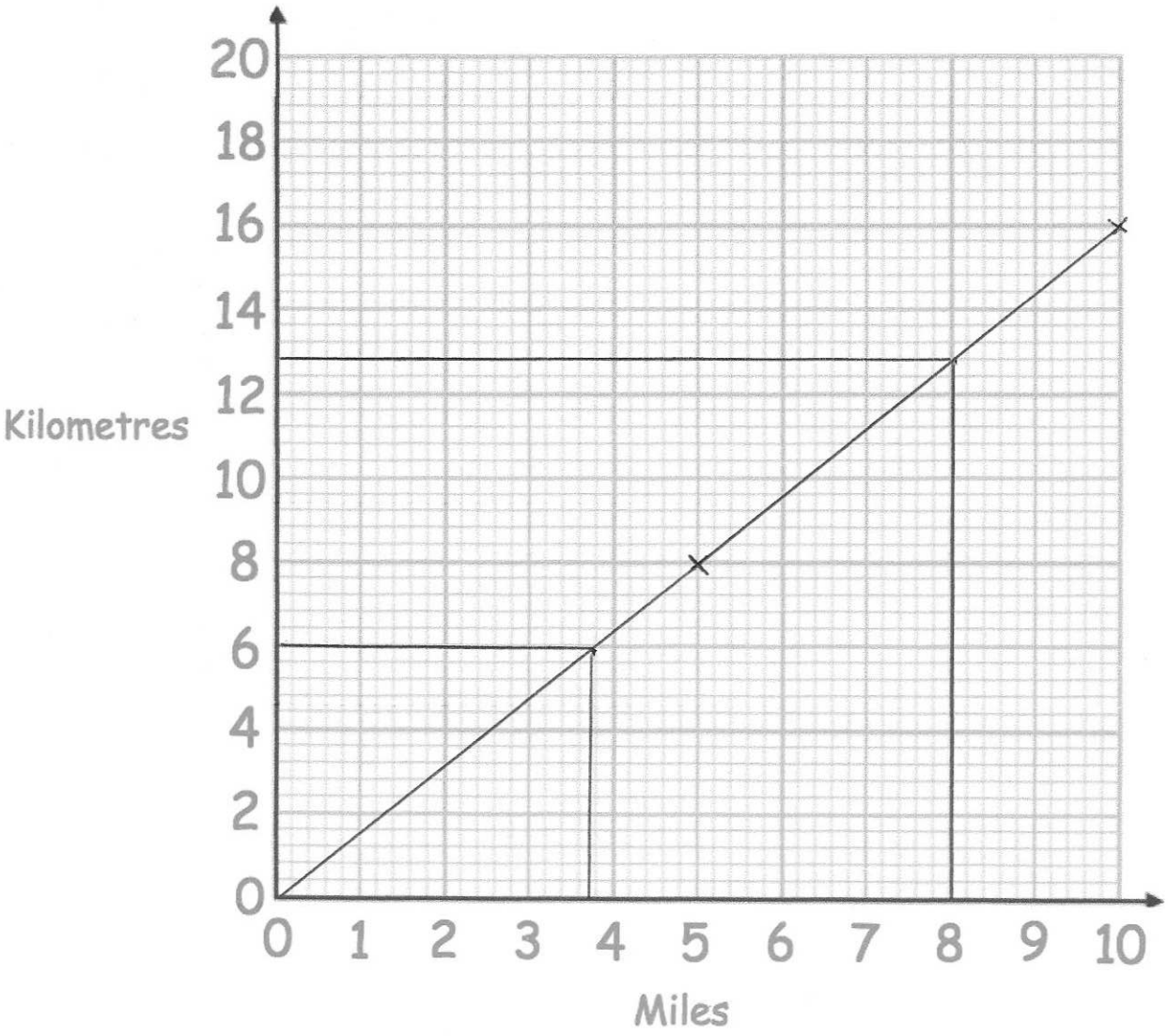
$74 \div 395 = 0.187$p per gram

The 215g is best value.

(4)

51.

(a) Use the fact 5 miles = 8 kilometres to draw a conversion graph on the grid.



(2)

Use your graph to convert

(b) 8 miles to kilometres

or 12.7 etc

12.8 km

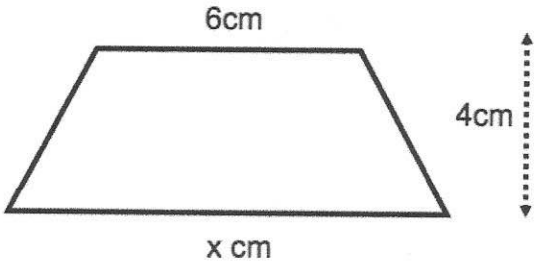
(1)

(c) 6 kilometres to miles

3.75 miles

(1)

52.



The area of the trapezium is 34cm².

Work out the value of x.

$A = \frac{1}{2}(a+b)h$

$34 = \frac{1}{2}(6+x)4$

$68 = (6+x)4$

$17 = 6+x$

$x = 11$

.....11.....cm

(2)

53. The number of passengers on 10 buses was recorded.
The stem and leaf diagram shows this information.

Key: 1|4 means 14 passengers

0	7 9
1	4 5 6 8 8
2	1 3
3	0

(a) Work out the median.

17

(1)

A bus is selected at random.

(b) What is the probability the bus has more than 20 passengers?

3/10

(1)

The next bus has 32 passengers.

(c) Tick the box to show how this will effect the range.

The range will decrease	The range will stay the same	The range will increase
☐	☐	☑

30 - 7 = 23

32 - 7 = 25

(1)

54. 100 people study one language at a college.

Some people study French.
Some people study Spanish.
The rest of the people study German.

54 of the people are male.
20 of the 29 people who study Spanish are female.
31 people study German.
15 females study French.

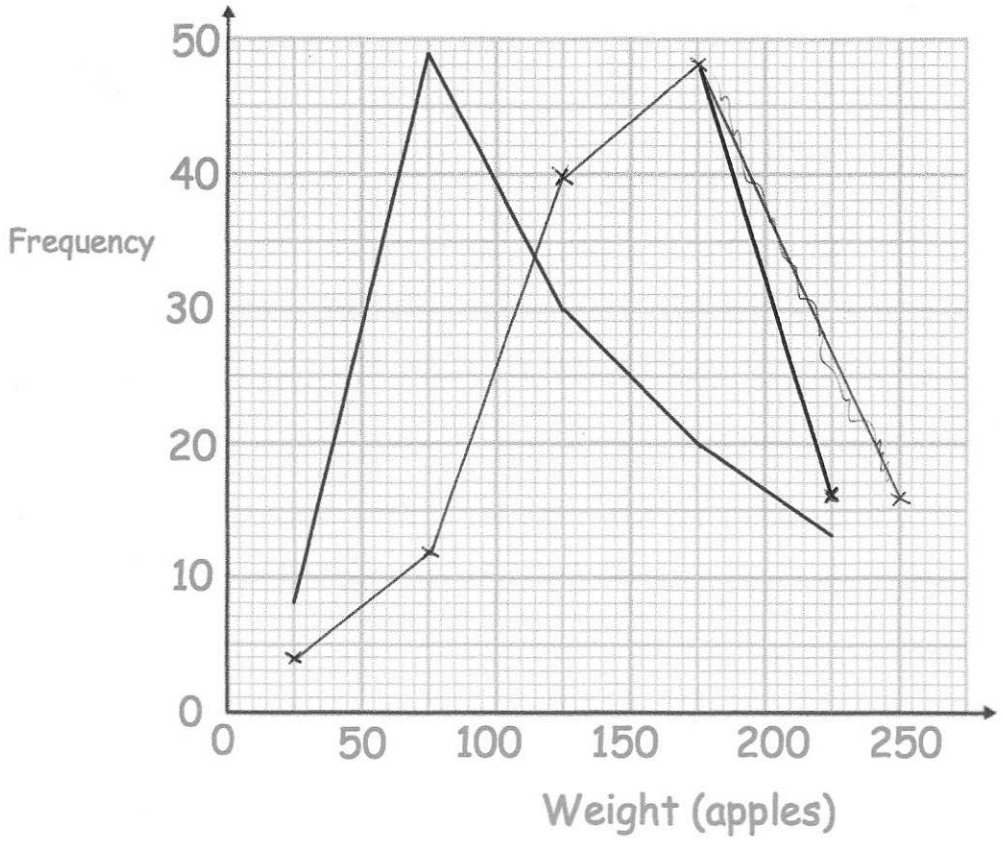
Work out the number of males who study German.

	Male	Female	Total
French	25	15	40
Spanish	9	20	29
German	20	11	31
Total	54	46	100

20

(4)

55. The frequency polygon shows the weights of 120 red apples.



The table shows the weights of 120 green apples.

Weight (kg)	Frequency
$0 < w \leq 50$	4
$50 < w \leq 100$	12
$100 < w \leq 150$	40
$150 < w \leq 200$	48
$200 < w \leq 250$	16

(a) Draw a frequency polygon to show this information on the diagram above.

(2)

(b) Compare the two distributions.

The weights of the green apples are higher/heavier than the red apples; the peak (mode) for the green apples is much further to the right.

(2)

5b. Simplify

$$\frac{a^{1/5} \times a^{2/3}}{a^{3/5}}$$

$$\frac{1}{5} + \frac{2}{3} = \frac{13}{15}$$

$$\frac{13}{15} - \frac{3}{5} = \frac{4}{15}$$

$a^{4/15}$

(2)

57. $v = u + at$

Work out a when $v = 62$, $u = 250$ and $t = 8$

$62 = 250 + 8a$

$-188 = 8a$

$8a = -188$

$a = -23.5$

-23.5

(3)

58 . Nigel measures the time, t seconds, to complete a race as 15.4 seconds correct to the nearest tenth of a second.

Write down the error interval for t.

$15.35 \leq t < 15.45$

(2)

59. Expand and simplify $(x - 6)(x + 1)(x - 2)$

$(x-6)(x+1) = x^2 - 5x - 6$

$(x^2 - 5x - 6)(x-2)$

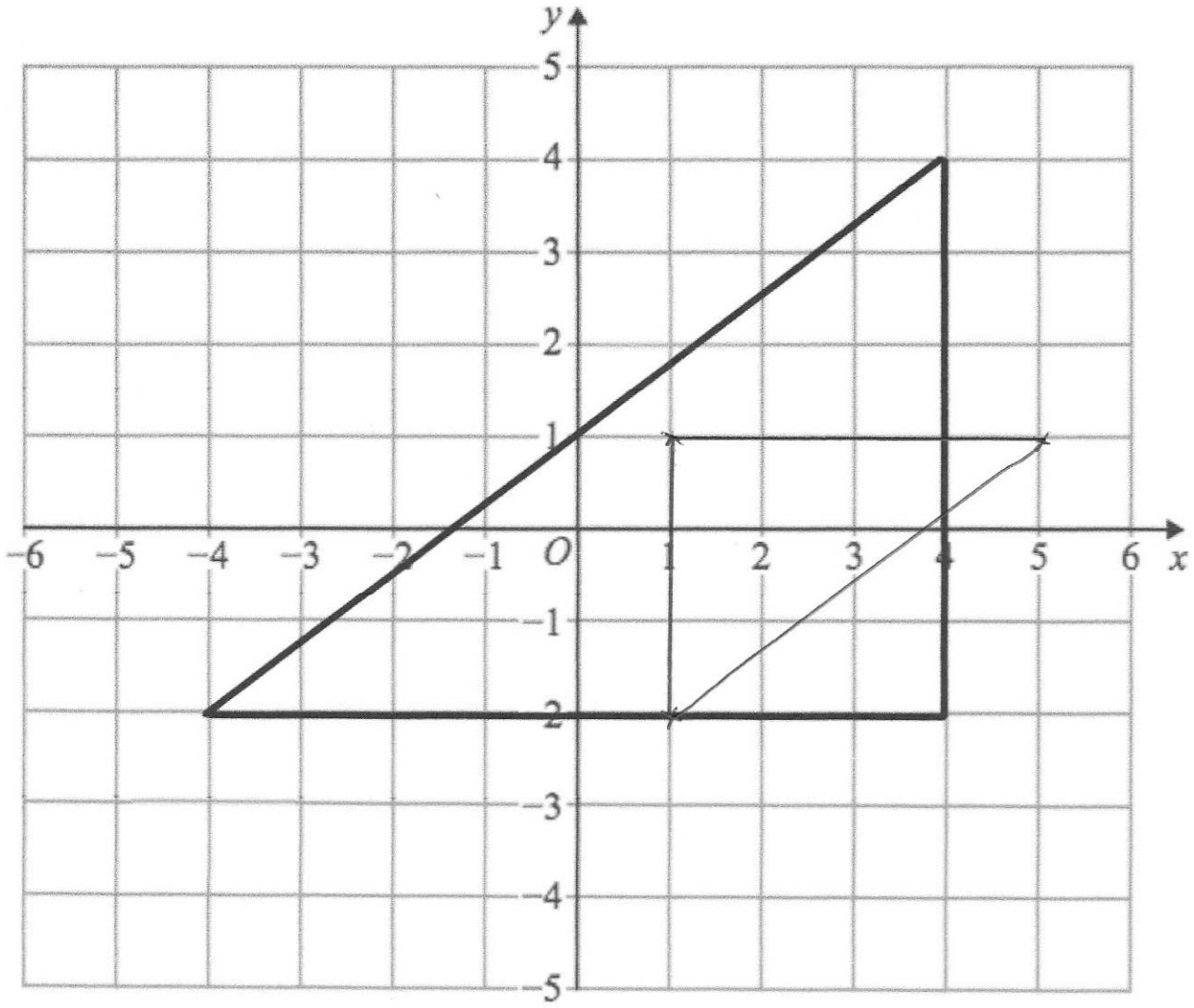
$x^3 - 2x^2 - 5x^2 + 10x - 6x + 12$

$x^3 - 7x^2 + 4x + 12$

$x^3 - 7x^2 + 4x + 12$

(4)

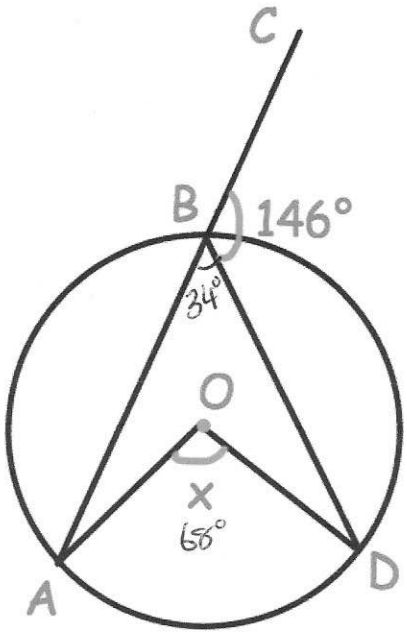
60.



Enlarge the triangle by scale factor $-\frac{1}{2}$, using centre of enlargement (2, 0)

(3)

61.



Shown is a circle with centre O.
ABC is a straight line.
Angle CBD is 146°

Find the size of angle AOD.

68 .....°

(3)