Paper 2 and Paper 3 Preparation Paper

AQA Higher

Corbettmaths

Ensure you have: Pencil, pen, ruler, protractor, pair of compasses and eraser

You will need a calculator

Guidance

1. Read each question carefully before you begin answering it.
2. Check your answers seem right.
3. Always show your workings

Paper 2 and 3 Checklist

Question	Topic	Video number
See website	Simultaneous Equations	295
See website	Exact Trig Values	341
See website	Translations	325
See website	Rotations	275
See website	Density	384
See website	Frequency Trees	376
See website	Quartiles	57a
See website	Tree Diagrams	252
See website	Conditional Probability	247
See website	Exponential Graphs	345
See website	Completing the Square	10, 371
See website	Transformations of Graphs	323, 324

1. Use your calculator to work out

$$\sqrt{39.3^2 - 1.24^2}$$

Write your answer to 3 significant figures.

39.280432 79

39.3

.....

(2)

2. 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.

$40 \div 215 = 0.186p$ per gram

$74 \div 395 = 0.187p$ per gram

the 215g tin is best value

(4)

3. Find the Lowest Common Multiple (LCM) of 60 and 72.

60

2 × 30

2 × 15

3 × 5

72

2 × 36

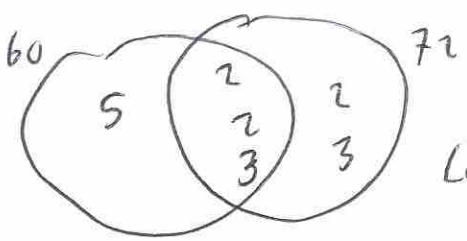
2 × 18

2 × 9

3 × 3

$60 = 2 \times 2 \times 3 \times 5$

$72 = 2 \times 2 \times 2 \times 3 \times 3$



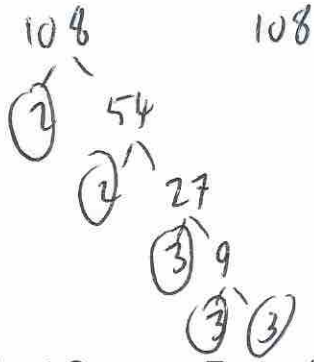
$LCM = 5 \times 2 \times 2 \times 3 \times 2 \times 3$

$= 360$

360

(2)

4. (a) Express 108 as a product of its prime factors.
Give your answer in index form.



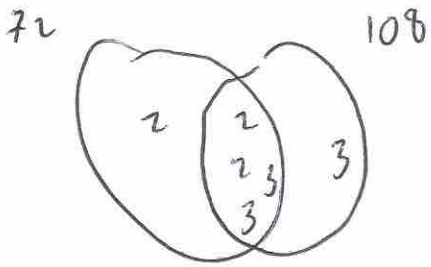
$108 = 2 \times 2 \times 3 \times 3 \times 3$

$2^2 \times 3^3$

.....

(3)

(b) Find the Highest Common Factor (HCF) of 108 and 72.



$HCF = 2 \times 2 \times 3 \times 3$

$= 36$

36

.....

(2)

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5. Harriet travelled from Bath to Cardiff.
Her average speed was 58 miles per hour.

There is traffic on the return journey.
Her average speed is reduced by 23%

Work out the average speed on the return journey.

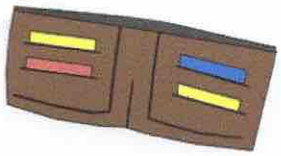
58×0.77

44.66

.....mph

(3)

6 Terry goes to the Post Office to exchange money.



$ £ €

Exchange Rates

£1 : $1.55

£1 : €1.24

*Commission Charged

Terry changes $651 and €161.20 into pounds sterling.
The Post Office deducts their commission and gives Terry £528.

What is the percentage commission?

$651 ÷ 1.55 = £420

€161.20 ÷ 1.24 = £130

£550

22/550 × 100 = 4

4 .....%

(4)

---

7 Nina invested £1500 for 4 years at 2.5% per annum simple interest.

Work out the total amount of money in the account at the end of 4 years.

1500 × 0.025 = £37.50

£37.50 × 4 = £150

1500 + 150

£ 1650

(3)

8 Martyn has some money to invest and sees this advert.

Bank of Maths

Double your money in 15 years.

The average annual growth for your investment is 4.5%

Will Martyn double his money in 15 years by investing his money with "Bank of Maths?"
You **must** show your workings.

let Martyn have £100

$100 \times 1.045^{15} = £193.53$

No, he will not double his money in 15 years.

(4)

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9 In a sale the price of a sofa is reduced by 70%.
The sale price is £255

Work out the price before the sale.

30% → 255

1% → 8.5

100% → 850

£ 850

(3)

10. Show algebraically that $0.3\dot{0}\dot{9}$ can be written as $\frac{17}{55}$

$x = 0.30909\ldots$

$10x = 3.0909\ldots$

$1000x = 309.0909\ldots$

$990x = 306$

$x = \frac{306}{990}$

$x = \frac{17}{55}$ ✓

(3)

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11. Chris and Molly win money in a competition.
They share the money in the ratio 2 : 3
Molly receives £240.

(a) How much money does Chris receive?

$240 \div 3 = 80$

$80 \times 2 = 160$

£ 160

(2)

(b) How much money did they win in the competition?

$160 + 240$

£ 400

(1)

---

12. y is directly proportional to the square of x.
When y = 24, x = 2.

Find the value of y when x = 4.

$y \propto x^2$

$y = kx^2$

$24 = k \times 4$

$k = 6$

$y = 6x^2$

$y = 6 \times 4^2$

$= 96$

y = 96

(3)

13. The time taken, t, for passengers to be checked-in for a flight is inversely proportional to the square of the number of staff, s, working.

It takes 30 minutes passengers to be checked-in when 10 staff are working.

(a) Find an equation connecting t and s.

$t \propto \frac{1}{s^2}$

$t = \frac{k}{s^2}$

$30 = \frac{k}{10^2}$

$k = 3000$

$t = \frac{3000}{s^2}$

.....

(3)

(b) What is the minimum number of staff that must be working so that the time taken is under 60 minutes?

$60 = \frac{3000}{s^2}$

$s^2 = 50$

$s = 7.07...$

8

.....

(3)

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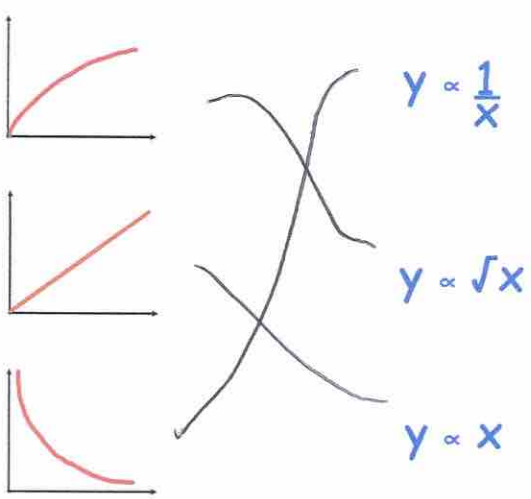
14. Match each graph to the correct relationship.



(3)

15. It takes 6 hours for 20 workers to seed 40 acres.

How long would it take 10 workers to seed 90 acres?

$6 \times 20 = 120$

$120 \div 40 = 3$ hr for 1 worker for 1 acre

$90 \times 3 = 270$ for 1 worker

$270 \div 10 = 27$

27 hrs

.....

(3)

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16. 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.

$S = \frac{d}{t}$ $\frac{205}{26.15} = 7.839...$

7.839

.....m/s

(2)

---

17. Ethan picks a 5-digit even number.

The first digit is odd 1, 3, 5, 7, 9
The second digit is prime 2 3 5 7
The fourth digit is a factor of 21 1 3 7

How many different 5-digit numbers could he pick?

1st 2nd 3rd 4th 5th

$5 \times 4 \times 10 \times 3 \times 5$

$= 3000$

3000

.....

(2)

18. 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.

$15.35 \leqslant t < 15.45$

(2)

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

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

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

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

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

(4)

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20. (a) Factorise $y^2 - 13y + 36$

$(y-4)(y-9)$

(2)

(b) Factorise $2w^2 - 9w + 4$

$(2w-1)(w-4)$

(2)

21. The first five terms in a sequence are 10, 17, 24, 31, 38 ...

Write down the nth term of the sequence.

	10	17	24	31
$7n$	7	14	21	28

$7n + 3$

.....

(2)

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22. 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.

	9	17	29	45	65
		8	12	16	20
			4	4	4

$2a = 4$

$a = 2$

$3a + b = 8$

$6 + b = 8$

$b = 2$

$a + b + c = 9$

$c = 5$

$2n^2 + 2n + 5$

.....

(3)

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23. Solve

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

$\frac{x+1 - (x+3)}{(x+3)(x+1)} = 2$

$\frac{-2}{(x+3)(x+1)} = 2$

$-2 = 2(x+3)(x+1)$

$-2 = 2(x^2 + 4x + 3)$

$x^2 + 4x + 3 = -1$

$x^2 + 4x + 4 = 0$

$(x+2)(x+2) = 0$

$x = -2$

.....

(5)

24 Make v the subject of the formula.

$$s = \frac{1}{2}(u + v)t$$

$2s = (u+v)t$

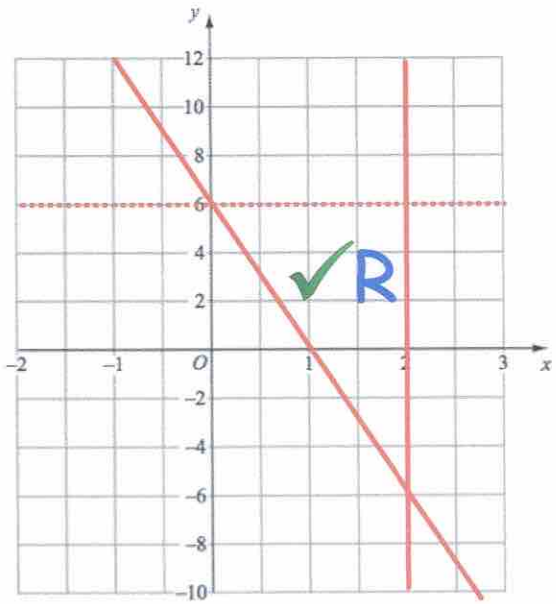
$\frac{2s}{t} = u + v$

$\frac{2s}{t} - u$

v = ...

(3)

25



The region labelled R satisfies three inequalities.

State the three inequalities

$y \leq 6$

.....

$x \leq 2$

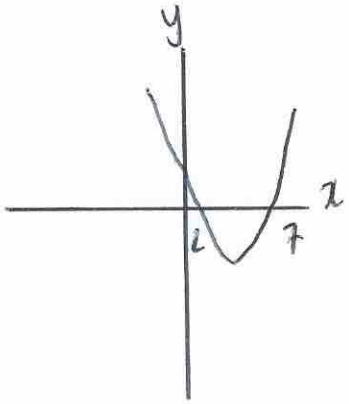
.....

$y \geq -6x + 6$

.....

(3)

26. Solve the inequality $x^2 - 9x + 14 \leq 0$



$y = (x-2)(x-7)$

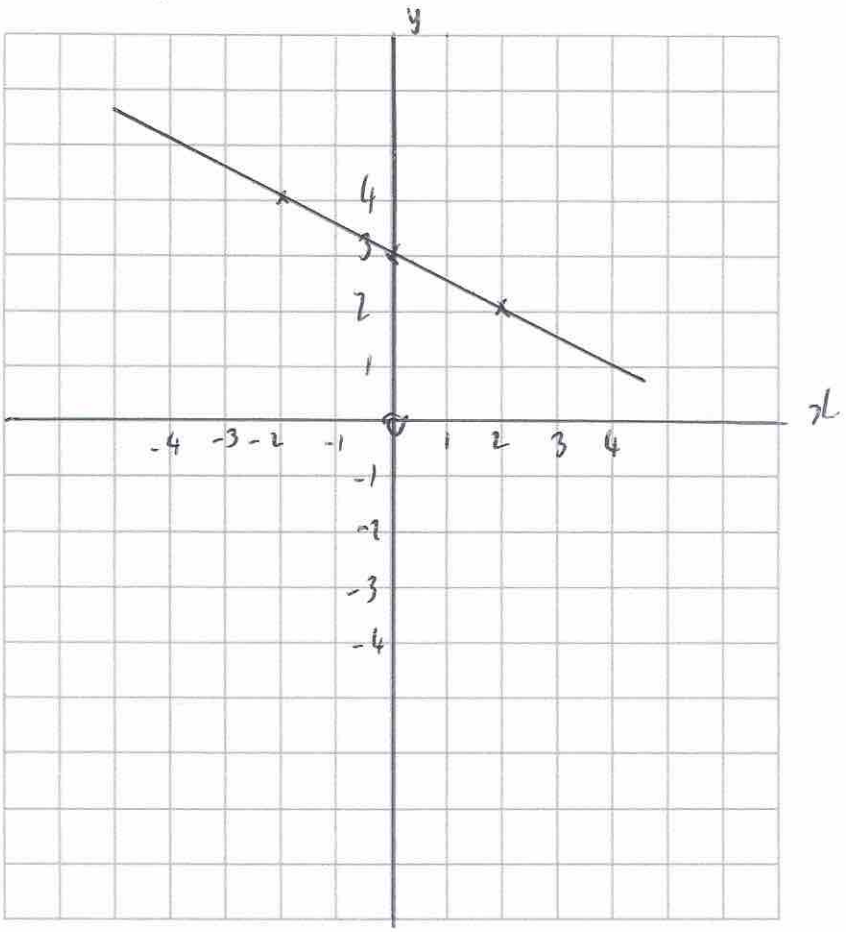
$x = 2 \quad x = 7$

$2 \leq x \leq 7$

(3)

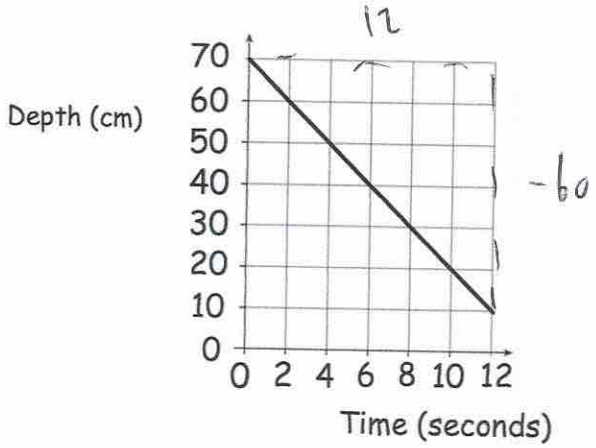
27. On the grid, draw $x + 2y = 6$ for values of x from –2 to 2.

x	-2	-1	0	1	2
y	4	3.5	3	2.5	2



(4)

28. The graph below shows the depth of water in a container.



(a) Write down the gradient of the line

$\frac{-60}{12} = -5$

-5.

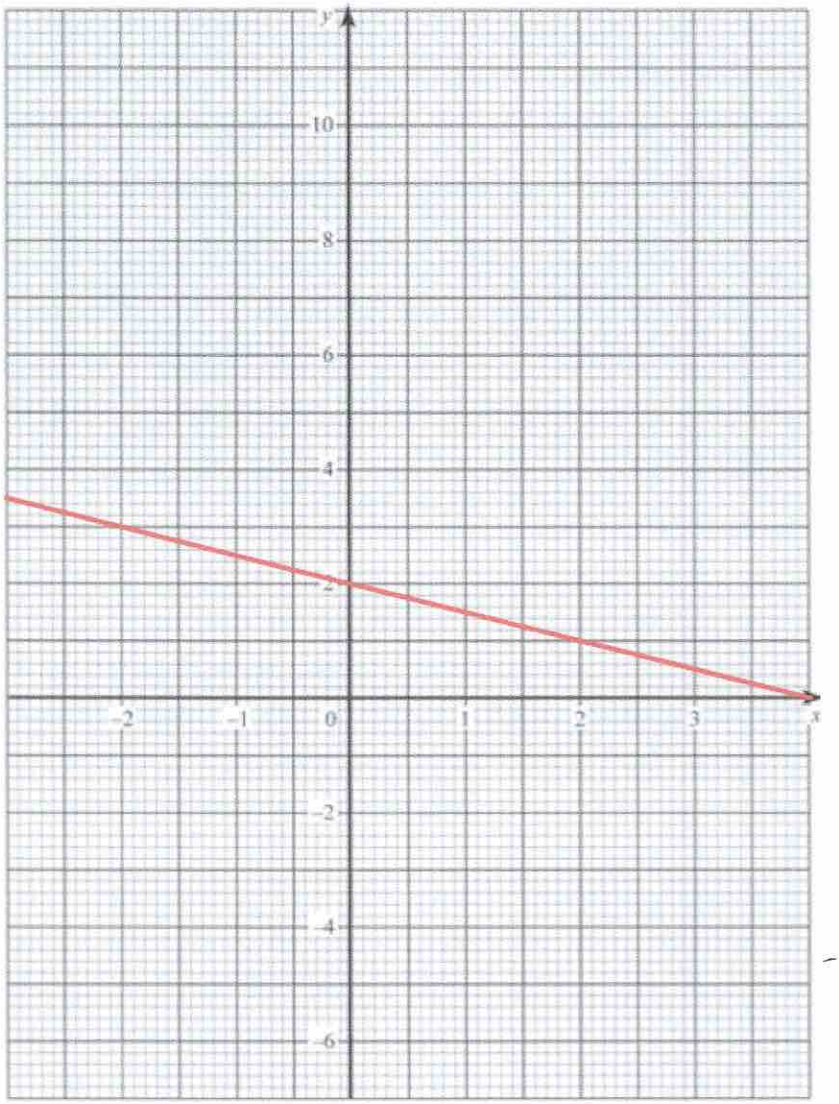
(1)

(b) What does the gradient of the line represent?

The change in depth of water each second.
Decrease of 5cm per second.

(1)

29



The straight line L has equation $y = -\frac{1}{2}x + 2$

(a) Write down the equation of a line parallel to L

$y = -\frac{1}{2}x + 15$

(1)

x y

(b) Find an equation of the line that goes through the point (1, 6) and is perpendicular to L

$m = 2$

$y = 2x + c$

$6 = 2 + c$

$c = 4$

$y = 2x + 4$

(3)

30 Solve the simultaneous equations

$2x + y = 5$
$2x^2 + y^2 = 11$

$y = 5 - 2x$

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

$2x^2 + 25 - 10x - 10x + 4x^2 = 11$

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

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

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

$x = \frac{7}{3}$ or $x = 1$

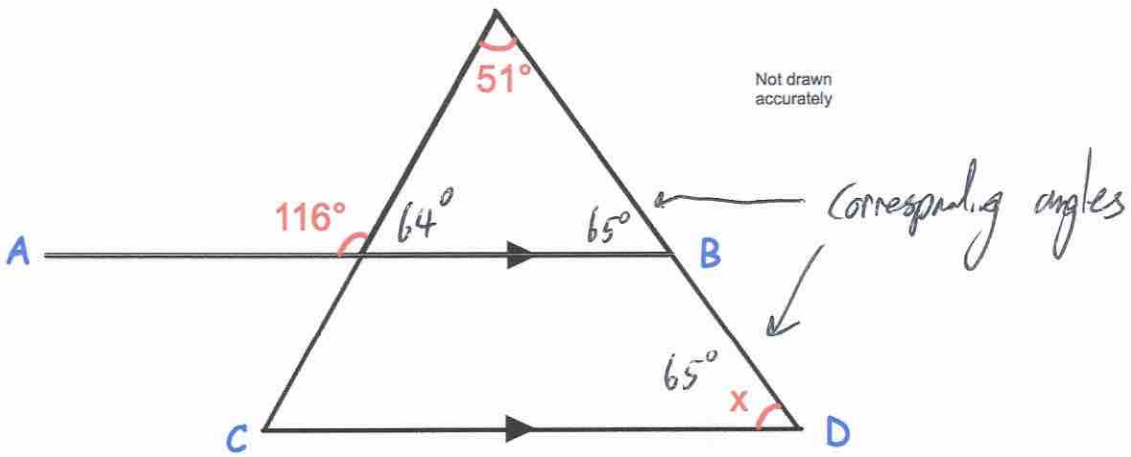
$x = \frac{7}{3}$, $y = \frac{1}{3}$

or

$x = 1$, $y = 3$

(4)

31 In the diagram, AB is parallel to CD.



Work out the size of angle x.

You **must** show your workings.

$180 - 116 = 64$

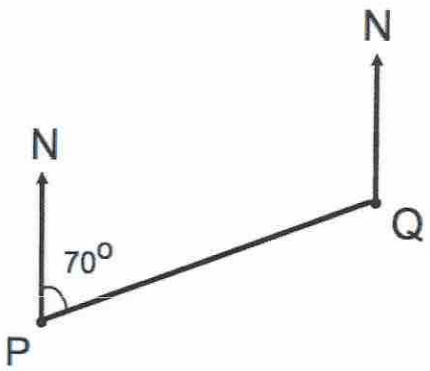
$51 + 64 = 115$

$180 - 115 = 65$

65 °

(4)

32. The diagram shows the position of two airplanes, P and Q.



Not drawn accurately

The bearing of Q from P is 070°

Calculate the bearing of P from

$360 - 110$

250 .....°

(2)

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33. The sum of the interior angles in a polygon is 7380°

Calculate the number of sides the polygon has.

$(n-2) \times 180 = 7380$

$n-2 = 41$

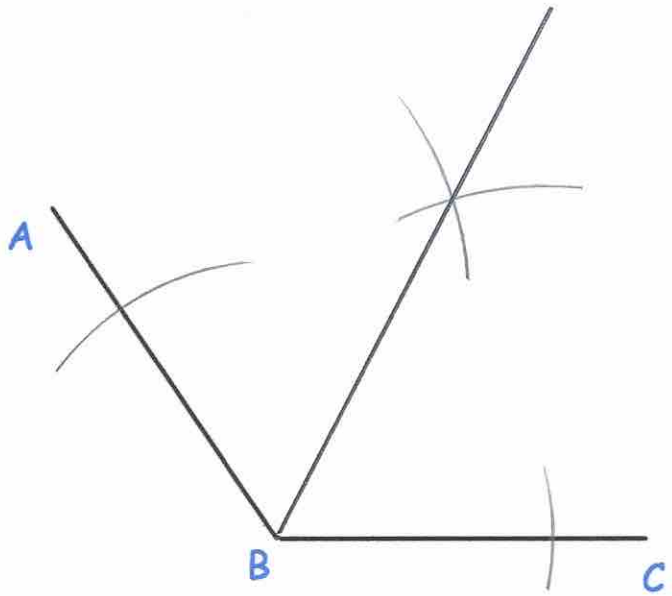
$n = 43$

43

.....

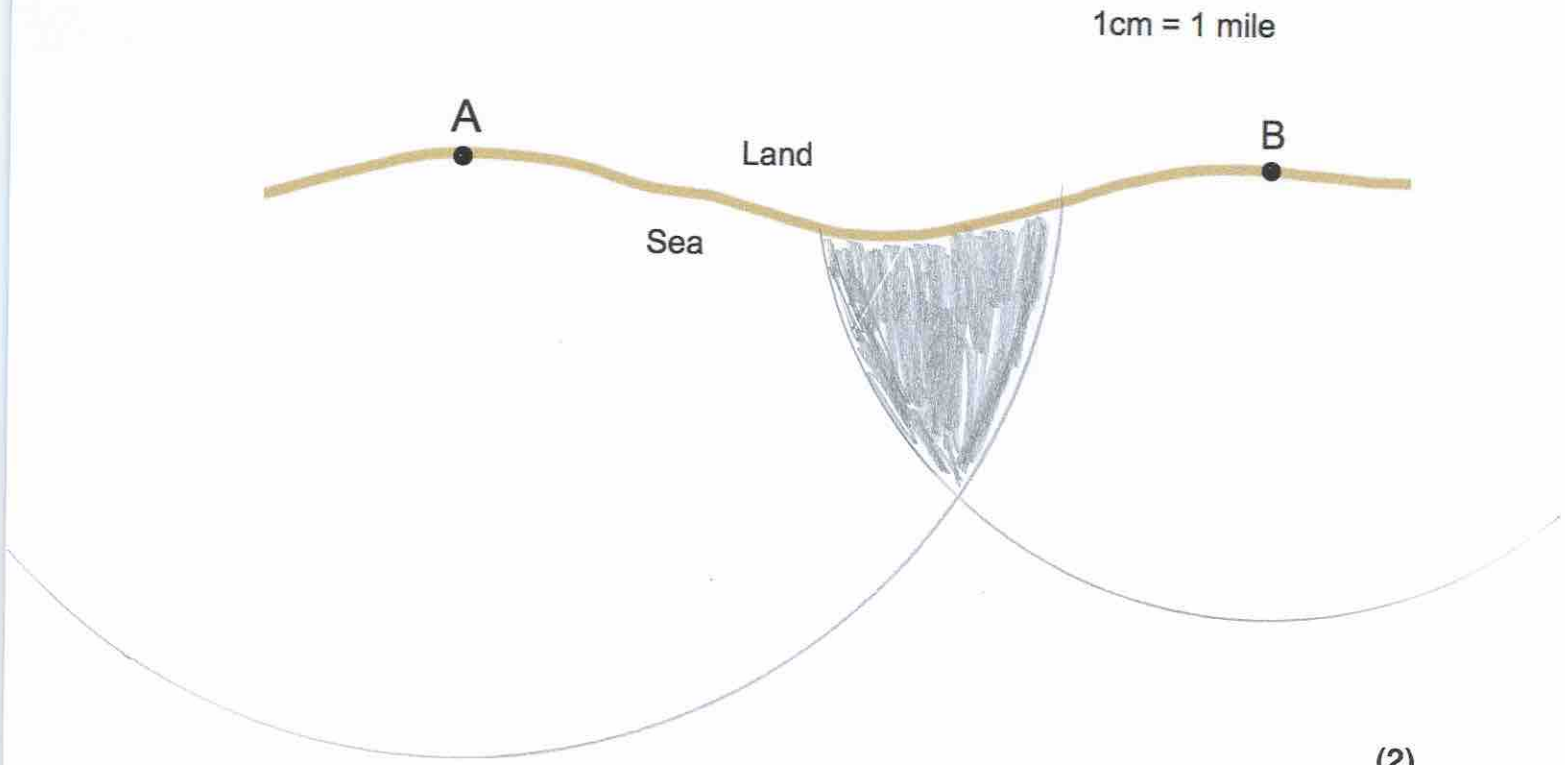
(2)

34. Using ruler and compasses, construct the bisector of angle ABC.



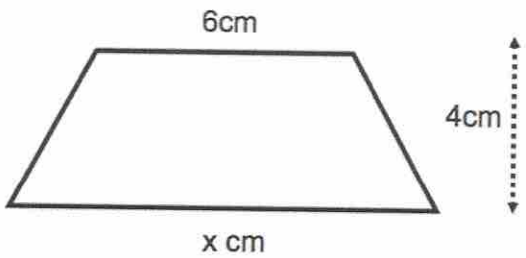
(2)

35. The diagram shows two lighthouses.
A boat is within than 8 miles of lighthouse A.
The same boat is within 6 miles of lighthouse B.
Shade the possible area in which the boat could be.



(2)

36.



The area of the trapezium is 34cm².

Work out the value of x.

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

$6 + x = 17$

11 .....cm

(2)

37. James has a bicycle.
Each wheel has diameter 45cm.

James cycles his bicycle in a straight line in the playground.
The front wheel makes 15 complete revolutions.

How far does the bicycle travel?
Give your answer in metres.

$\pi \times 45 = 141.3716...$

$141.3716... \times 15 = 2120.57...$

$\div 100$

21.206 .....m

(4)

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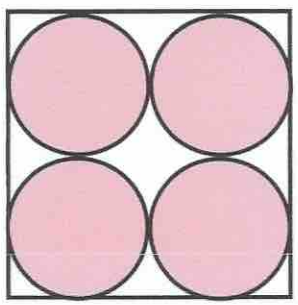
38. A logo is designed that has four pink circles within a white square.



16cm

The square has side length 16cm.

Find the area of the logo that is white.

$\pi \times 4^2 = 50.265...$

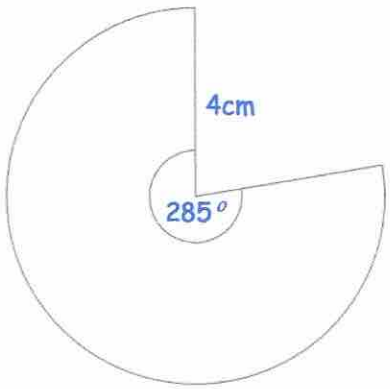
$50.265... \times 4 = 201.0619...$

$16 \times 16 = 256$

$256 - 201.0619...$ 54.94 .....cm²

(5)

39.



Calculate the perimeter of the sector.

$\frac{285}{360} \times \pi \times 8 = 19.896\ldots$

$19.896\ldots + 4 + 4$

27.897

..... cm

(3)

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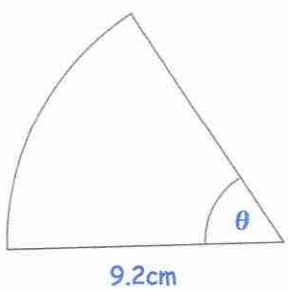
40. Shown is a sector of a circle with radius 9.2cm.



The area of the sector is 38.4cm²

Find the size of angle θ
Give your answer to 2 significant figures.

$\frac{\theta}{360} \times \pi \times 9.2^2 = 38.4$

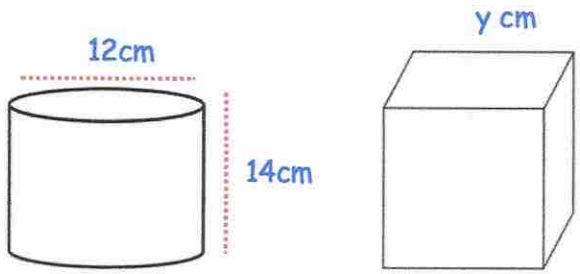
$\frac{\theta}{360} = 0.144$

52

..... °

(3)

41.



A cylinder has diameter 12cm and height 14cm.
A cube has side length y cm.
The cylinder and cube has the same volume.

Find y.

Cylinder $\pi \times 6^2 \times 14$

$= 1583.3626...$

$\sqrt[3]{1583.3626...}$

11.66 ..... cm

(4)

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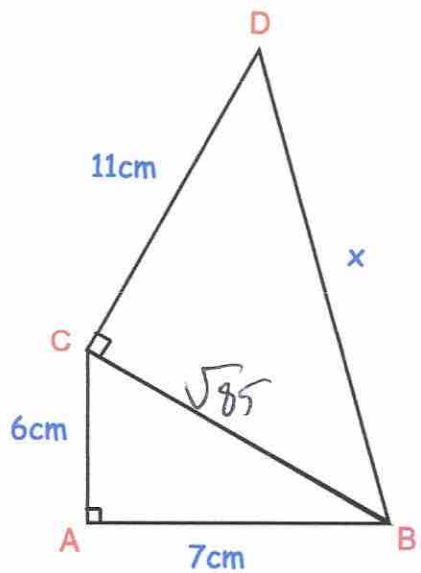
42. Below are two triangles, ABC and BCD.



Find x

$6^2 + 7^2 = BC^2$

$BC = \sqrt{85}$

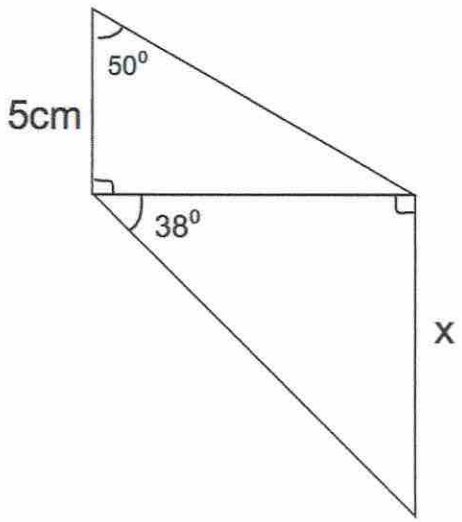
$(\sqrt{85})^2 + 11^2 = BD^2$

$BD = \sqrt{206}$

14.35 .....cm

(4)

43. The diagram shows two right-angled triangles.



Calculate the value of x.

$y = \tan(50) \times 5$

$= 5.9587$

$x = \tan(38) \times 5.9587$

4.655

.....cm

(5)

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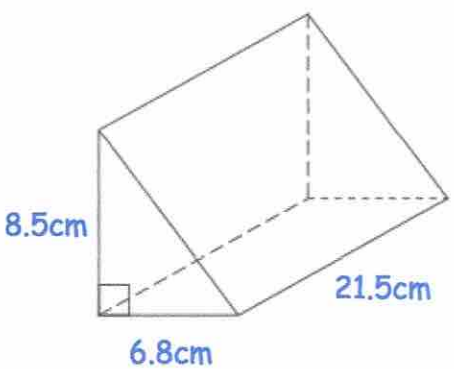
44. Shown below is a triangular prism.



Find the volume of the triangular prism.

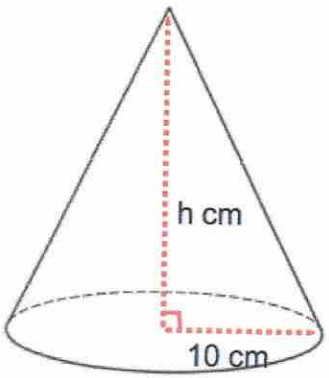
$V = \frac{1}{2} \times 6.8 \times 8.5 \times 21.5$

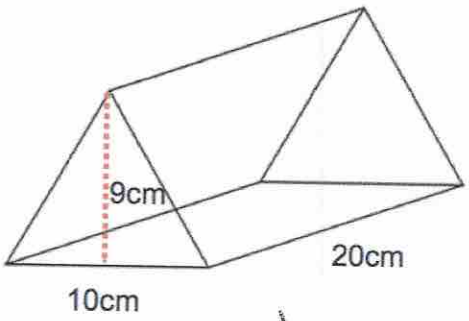
621.35

.....cm³

(3)

45. Shown is a cone and a triangular prism.





Both solids have the same volume.

Calculate the height of the cone.

$\frac{1}{2}(10)(9)(20)$

$= 900\text{cm}^3$

$900 = \frac{1}{3}\pi(10)^2 h$

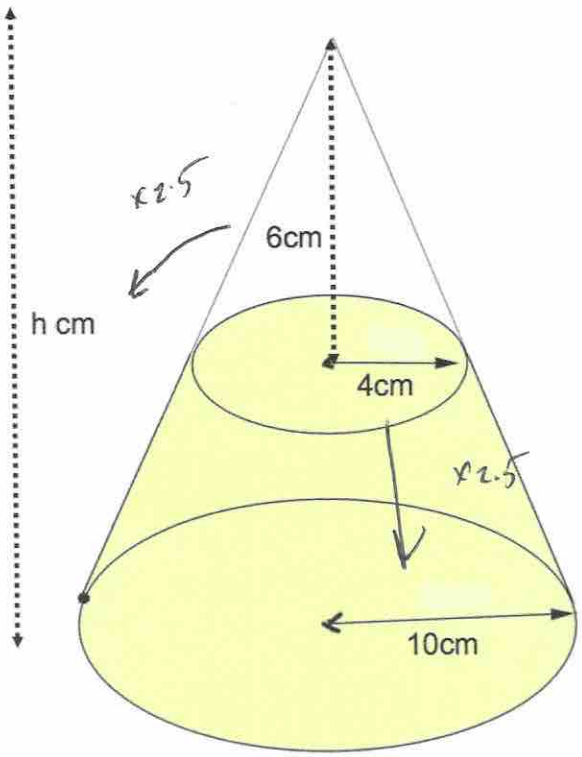
$h = 8.59\ldots$

8.6

.....cm

(3)

46 A cone below has base radius 10cm and height h cm.
A smaller cone radius 4cm and height 6cm is cut from the top.
The frustum is shown below.



10 ÷ 4 = 2.5

Calculate the volume of the frustum.

large cone: $\frac{1}{3} \pi \times 10^2 \times 15 = 500\pi$

small cone: $\frac{1}{3} \pi \times 4^2 \times 6 = 32\pi$

$500\pi - 32\pi = 1470.265...$ 1470.3 ..... cm^3

(5)

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47 A cube has a volume of $343cm^3$

Work out the surface area of the cube.

$\sqrt[3]{343} = 7$

$7 \times 7 = 49$

$49 \times 6 = 294$

294 ..... cm^2

(2)

48. A sphere has a radius of 5cm.

Calculate the surface area of the sphere.

$4 \times \pi \times 5^2 = 100\pi$

$314.16 cm^2$

.....

(3)

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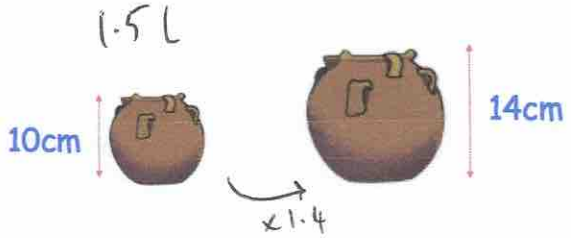
49. Mrs Hampton is potting plants.
She is using two mathematically similar pots, the smaller is 10cm tall and the larger 14cm tall.

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?

$30 \div 20 = 1.5\ L$

$1.5 \times 1.4^3 = 4.116\ L$

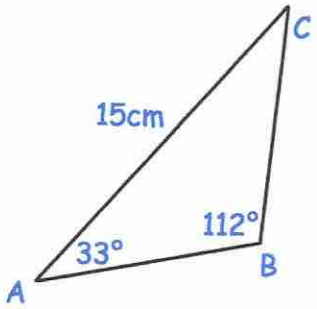
$30 \div 4.116 = 7.28$

7

.....

(5)

50



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

Work out the length of BC.

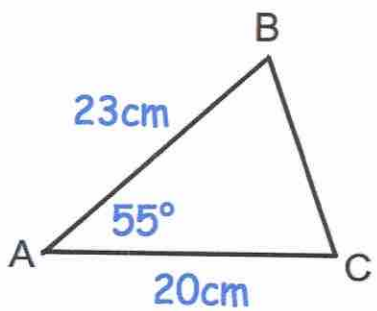
$$\frac{x}{\sin 33} = \frac{15}{\sin 112}$$

8.81

.....cm

to 2dp **(3)**

51



Calculate the length of BC.

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

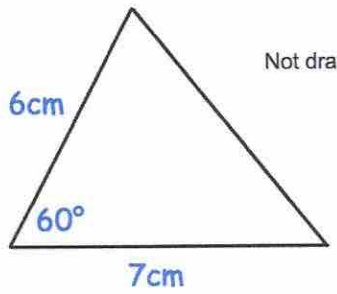
$$x^2 = 401.3\ldots$$

20.03

.....cm

(3)

52.



Calculate the area of the triangle.

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

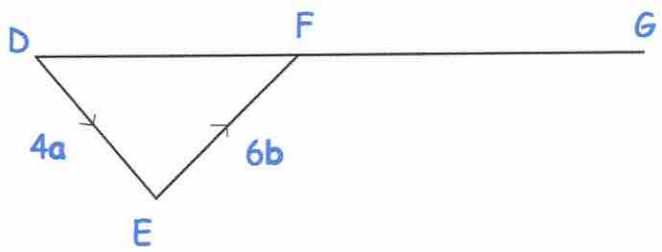
18.19 .....cm²

(2)

---

53. DFG is a straight line.

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



(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)

54. $\mathbf{a} = \begin{pmatrix} 9 \\ 6 \end{pmatrix}$ and $\mathbf{b} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

Work out $3\mathbf{a} - \mathbf{b}$

$3\underline{a} = \begin{pmatrix} 27 \\ 18 \end{pmatrix}$

$\underline{b} = \begin{pmatrix} 4 \\ -1 \end{pmatrix}$

$\begin{pmatrix} 23 \\ \cdots \\ 19 \\ \cdots \end{pmatrix}$

(2)

---

55. The speed limit on a road is 50 mph.

A car drives 19 miles in 22 minutes.

Is the car breaking the speed limit?
You must show your workings.

$19 \div 22 = 0.8636\ldots$ miles per min

$0.8636\ldots \times 60 = 51.81\ldots$ mph

yes

(3)

56. 100 students study one language at a college.

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

54 of the students are in Year 12.
20 of the 29 students who study Spanish are in Year 13.
31 students study German.
15 Year 13 students study French.

Work out the number of Year 12 students who study German.

	Yr 12	Yr 13	total
French	25	15	40
Spanish	9	20	29
German	20	11	31
total	54	46	100

20

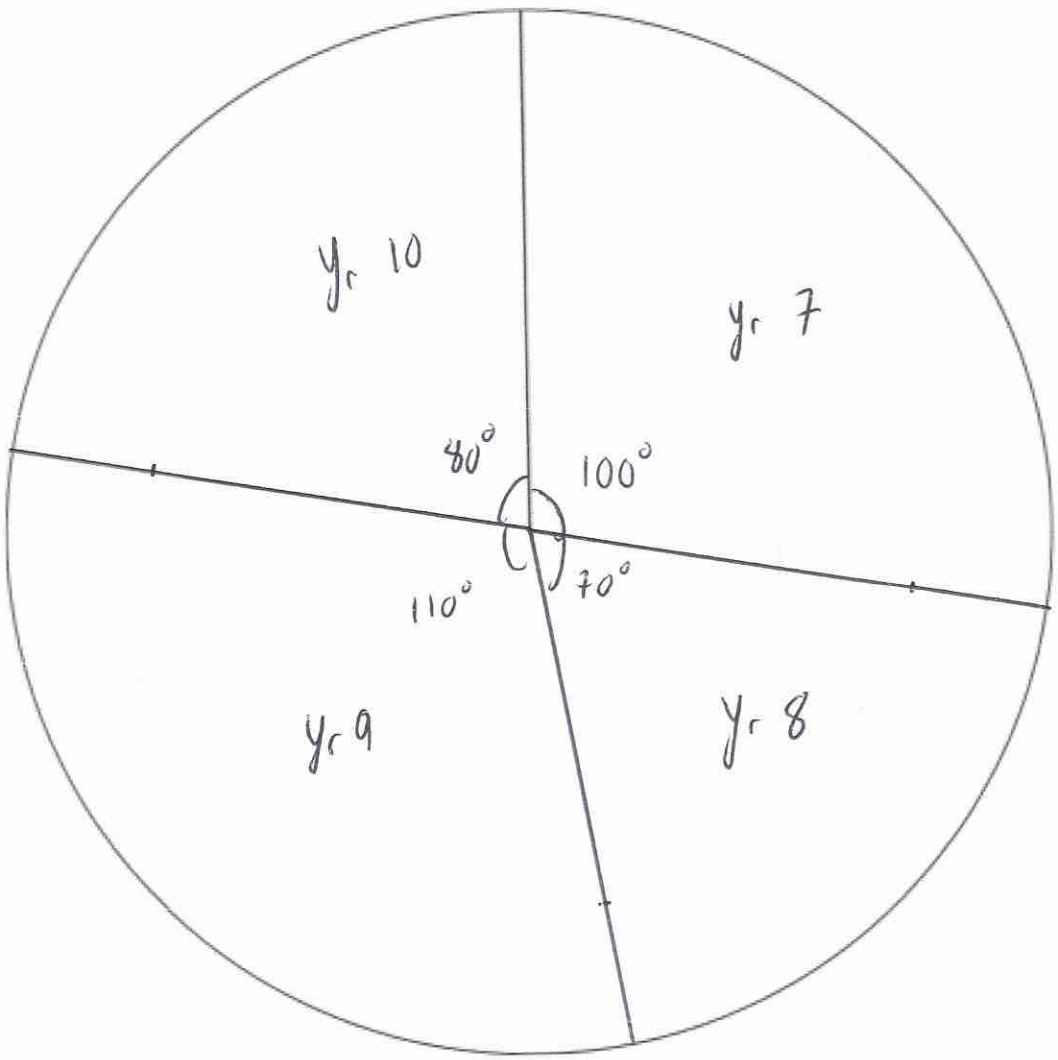
.....

(4)

57. The table gives information about the number of students in years 7 to 10.

Year	Frequency		Angle
7	200	×0.5	100°
8	140	×0.5	70°
9	220	×0.5	110°
10	160	×0.5	80°
	720		360°

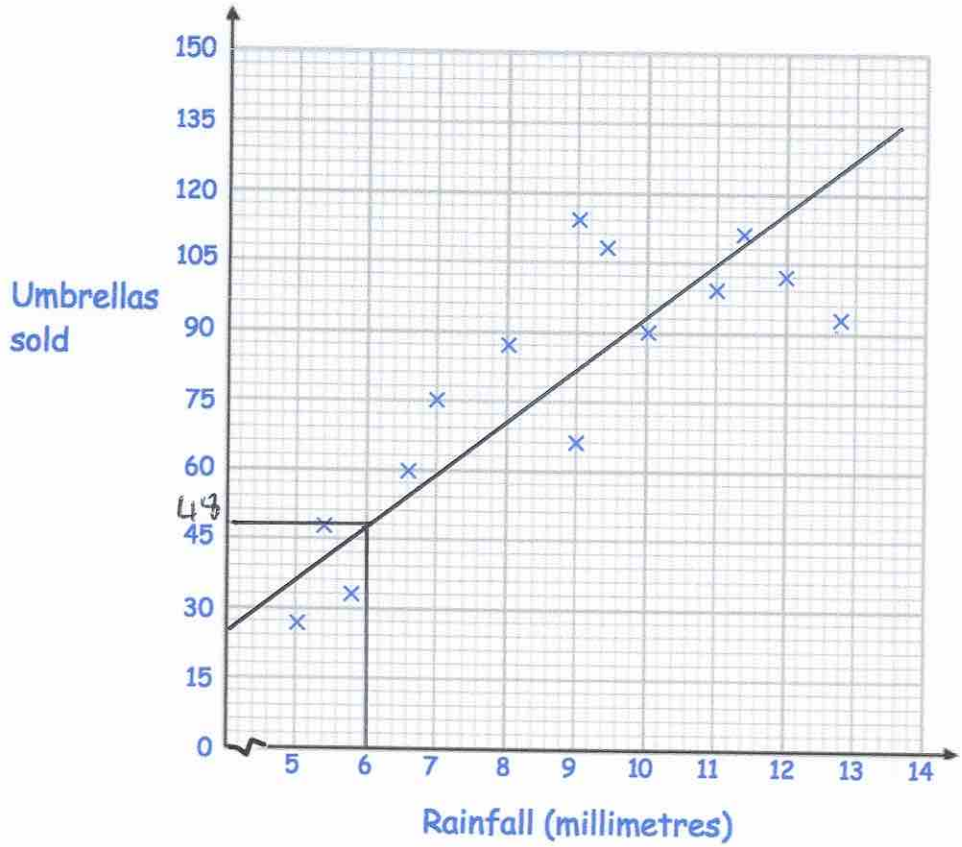
Draw an accurate pie chart to show this information.



(4)

58 A shop sells umbrellas.

The scatter graph shows information about the number of umbrellas sold each week and the rainfall that week, in millimetres.



(a) Describe the relationship between the rainfall and umbrellas sold.

As the rainfall increases, so does the number of umbrellas sold.

(1)

(b) What is the greatest amount of rainfall in one week?

12.8mm

(1)

In another week, there was 6mm of rain.

(c) Estimate the number of umbrellas sold.

48 umbrellas

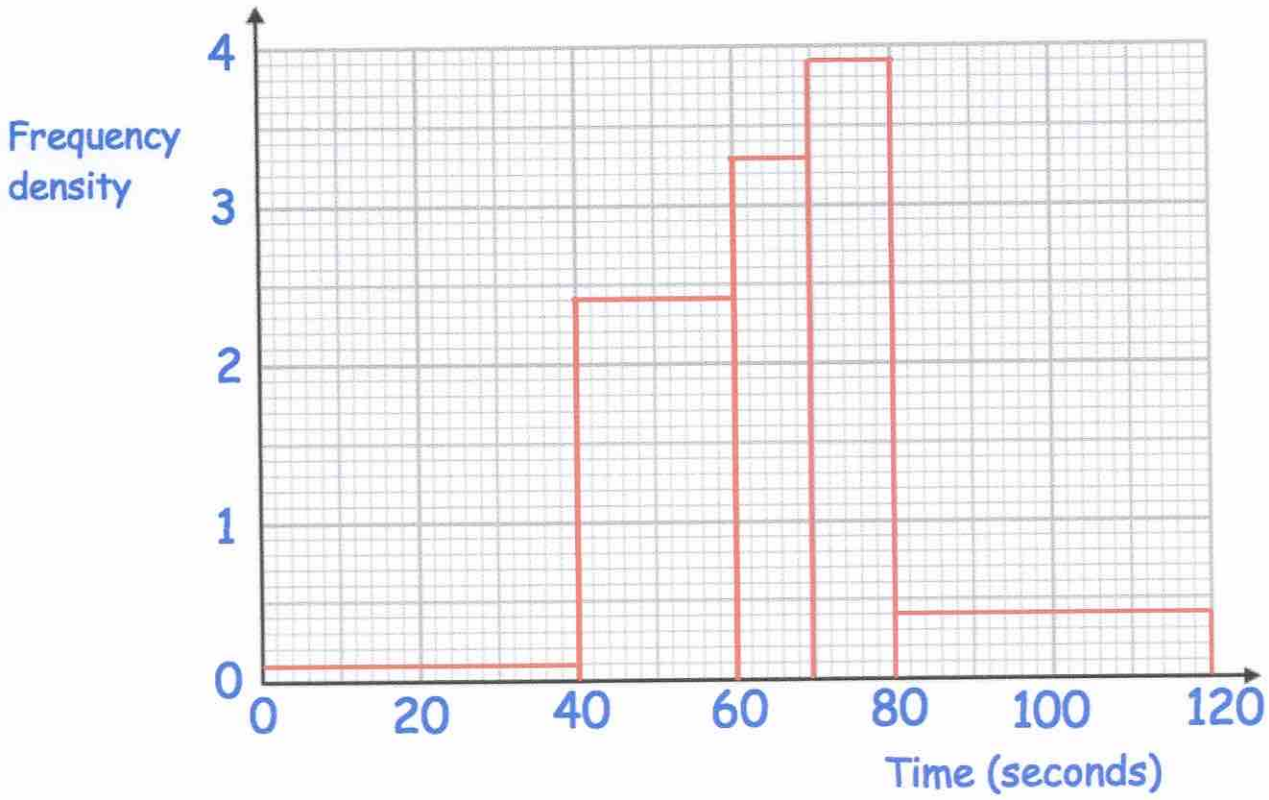
(2)

(d) Explain why it may **not** be appropriate to use your line of best fit to estimate the number of umbrellas sold in a week with 25mm of rainfall.

It is beyond the range of the given data.
Extrapolation is unreliable.

(1)

59 The histograms shows information about the time taken by 140 students to complete a puzzle.



(a) Complete this frequency table.

Time, t seconds	Frequency
$0 < t \leq 40$	4
$40 < t \leq 60$	48
$60 < t \leq 70$	33
$70 < t \leq 80$	39
$80 < t \leq 120$	16

$20 \times 2.4 = 48$

3.9×10

(2)

(b) Calculate an estimate of the median.

70^{th} value

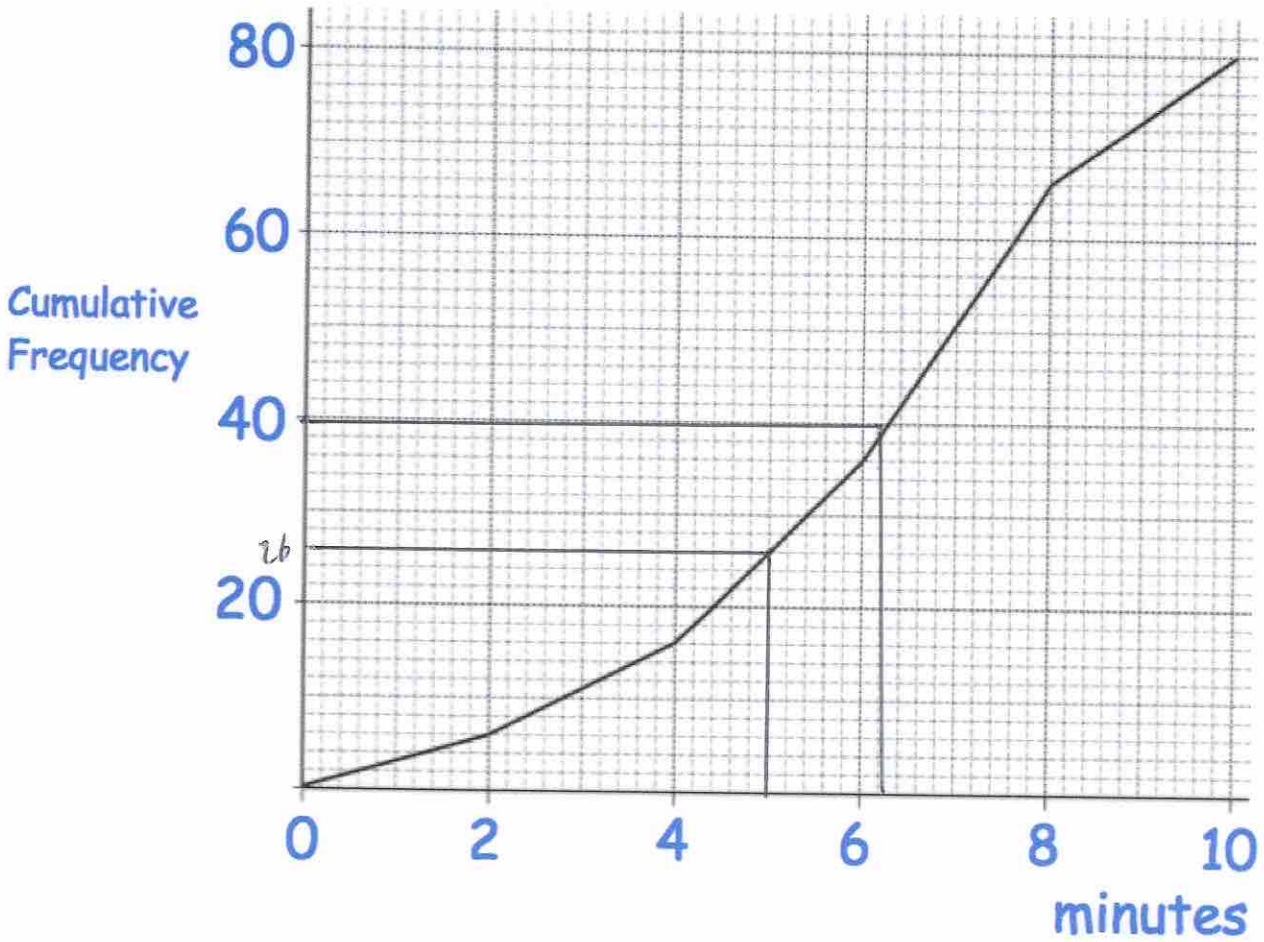
$60 + \frac{18}{33} \times 10$

65.455 seconds

.....

(3)

6 0. The length of time, in minutes, that 80 customers spend in a shop was recorded. A cumulative frequency diagram of this data is below.



(a) Find an estimate of the median.

6.2 (or 6.3)

.....minutes

(1)

(b) Estimate how many customers spent more than 5 minutes in the shop.

80 - 26 = 54

54

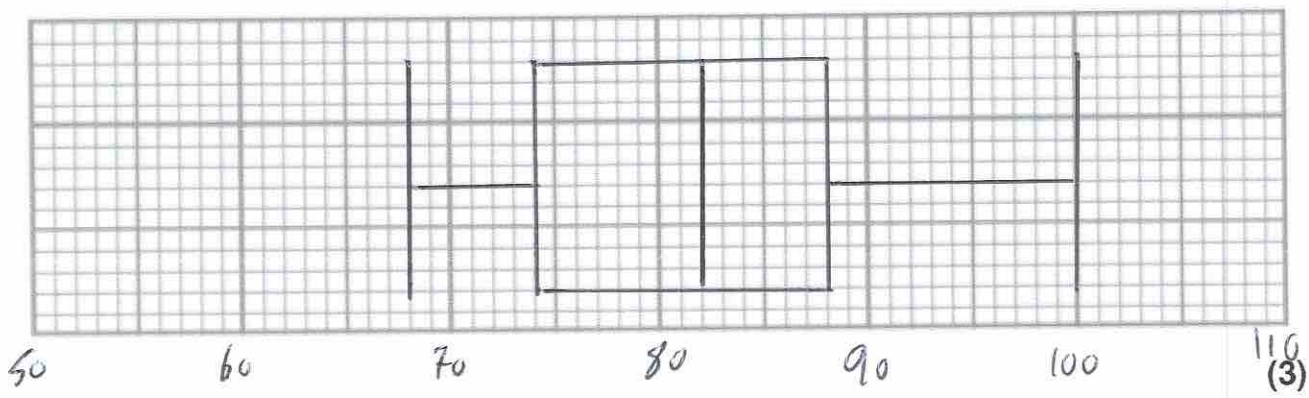
.....

(1)

61 The table gives information about the weights of 50 rugby players.

Lowest	68kg
Lower Quartile	74kg
Median	82kg
Upper Quartile	88kg
Highest	100kg

Draw a box plot to show this information.



(3)

62 Timothy weighs the mass of some oranges, in grams.
The table shows some information about his results.

Mass	Frequency		midpoint	fx
20 < m ≤ 25	12	×	22.5	270
25 < m ≤ 30	24	×	27.5	660
30 < m ≤ 35	17	×	32.5	552.5
35 < m ≤ 40	15	×	37.5	562.5
40 < m ≤ 45	4	×	42.5	170
				2215

Work out an estimate for the mean mass of an orange.

2215 ÷ 72

30.764

.....grams

(4)

to 3dp

63. 480 students attend a school.

A teacher asks 50 students which colour they would like the new school blazer to be.

The table shows the results.

Colour	Number of students
Black	20
Navy	15
Green	9
Maroon	6

Estimate how many of the 480 students would like a black blazer.

$\frac{20}{50} \times 480$

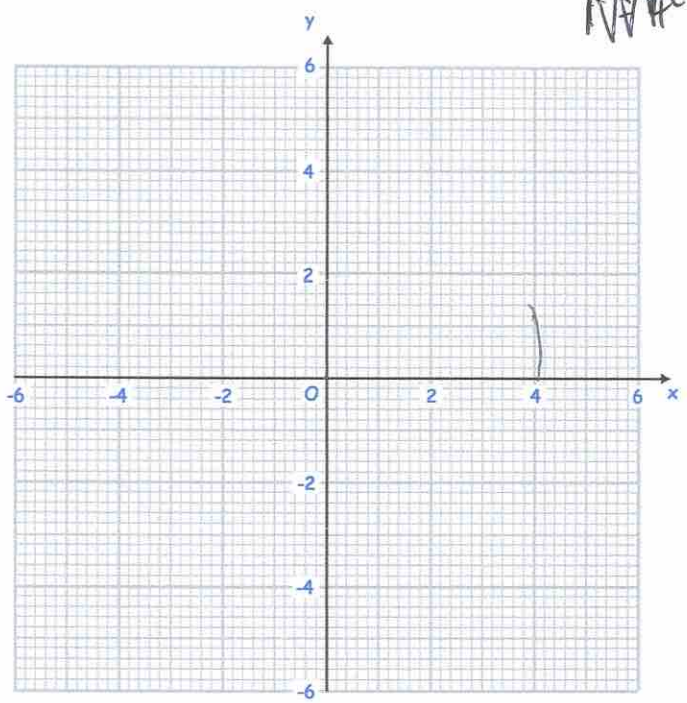
192

.....

(2)

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

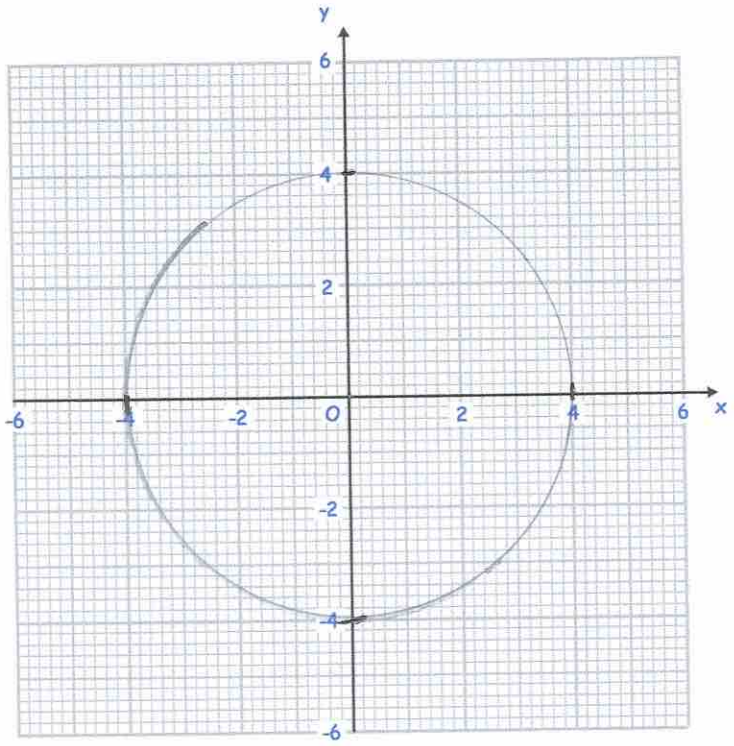
N/A



see next page

(2)

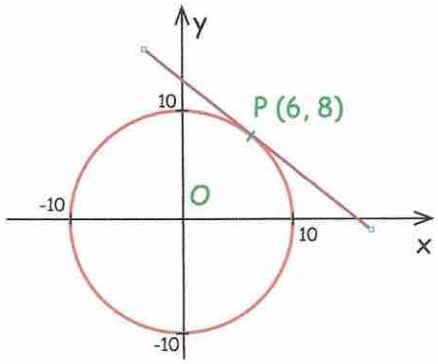
64 Draw the circle with equation $x^2 + y^2 = 16$



$r = 4$

(2)

65. 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 $= \frac{4}{3}$

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

$8 = -4.5 + c$

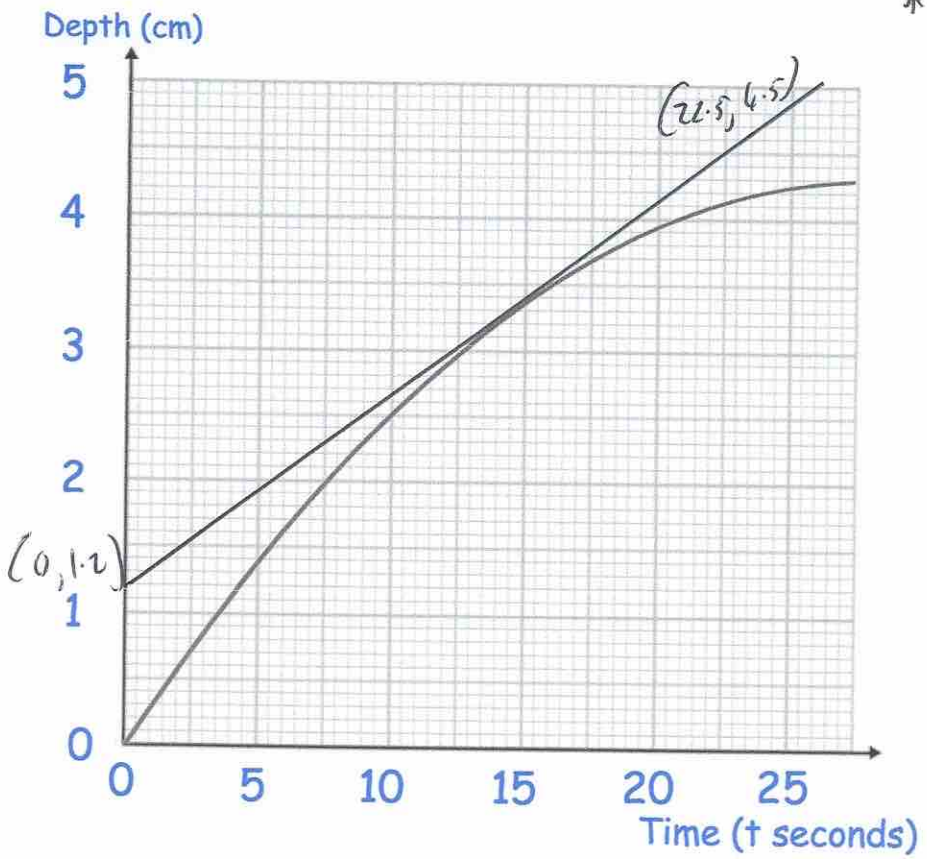
$c = 12.5$

$y = -0.7x + 12.5$

(4)

66. 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.

$\frac{\text{rise}}{\text{run}} = \frac{3.3}{22.5}$

0.146

(3)

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

It is the rate at which the depth of water is increasing at 15s. 0.1466... cm per second.

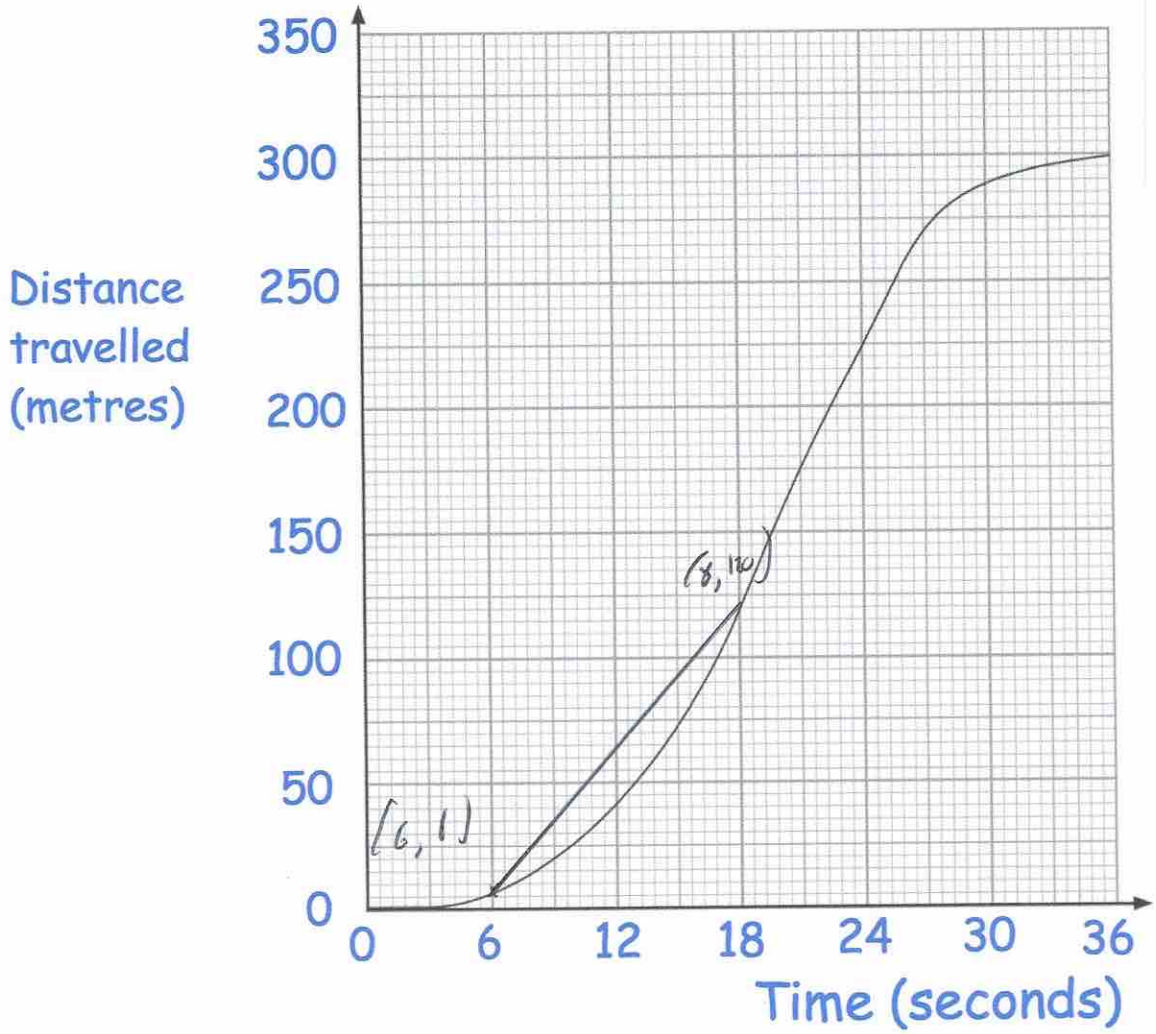
(2)

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

It is only a hand drawn tangent

(1)

67. The graph shows the distance travelled by a train over 36 seconds.



Work out the average speed of the train between 6 and 18 seconds.

$\frac{110}{12} = 9.5$

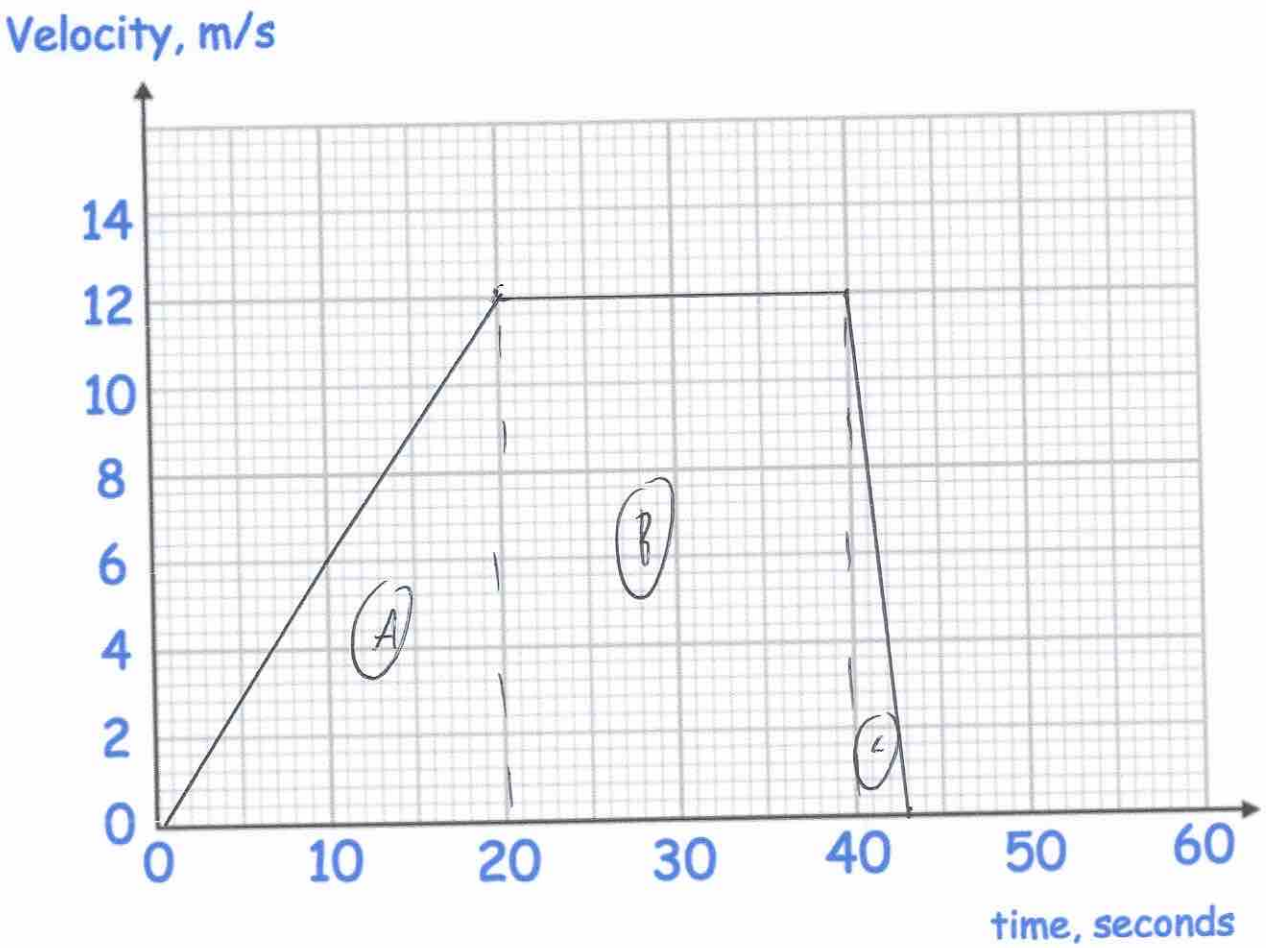
$9.\dot{5}$

.....m/s

(3)

68 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) $\frac{1}{2} \times 20 \times 12 = 120$

(B) $20 \times 12 = 240$

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

378 .....m
(2)

69. The functions $f(x)$ and $g(x)$ are given by the following:

$$f(x) = 5x - 1$$

$$g(x) = 2x + 4$$

(a) Calculate the value of $fg(3)$

$g(3) = 10$

$f(10) = 49$

49

(2)

(b) Calculate the value of $ff(10)$

$f(10) = 49$

$f(49) = 244$

244

(2)

---

70. The function f is such that $f(x) = 4x - 9$

(a) Solve $f(x) = 13$

$4x - 9 = 13$

$4x = 22$

$x = 5.5$

5.5

(2)

(b) Find $f^{-1}(x)$

$y = 4x - 9$

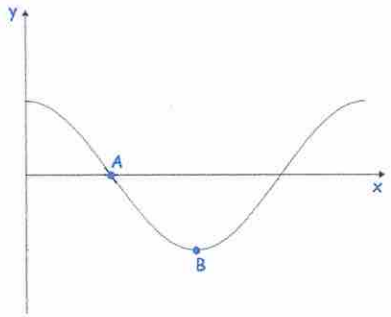
$y + 9 = 4x$

$x = \frac{y+9}{4}$

$f^{-1}(x) = \frac{x+9}{4}$

(2)

71. Here is the graph of $y = \cos x$



(a) Write down the coordinates of the point A.

(90 , 0)

(1)

(b) Write down the coordinates of the point B.

(180 , -1)

(1)

---

72. S is a geometric sequence.

The first three terms of S are $(x + 18)$, x and $(2x – 15)$, where x is positive.

Find the value of x.

$$\frac{x}{x+18} = \frac{2x-15}{x}$$

$$x^2 = (2x-15)(x+18)$$

$$0 = x^2 + 21x - 270$$

$$0 = (x+30)(x-9)$$

$x = 9$

9

(3)

---

73. Solve the equation $x^2 – 2x – 9 = 0$

Give your answers to two decimal places.

$a = 1 \quad b = -2 \quad c = -9$

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

x = 4.16 or x = -2.16

(3)

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

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

$x = 0 \qquad 0^3 + 0 - 1 = -1$

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

As there is a change of sign, 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)

75. Shown below is a 2 pence coin.

: 0.185cm

Each 2 pence coin is 0.185cm thick.
Stephen builds a tower of 250 2p coins.

How tall is the tower?

$0.185 \times 250 = 46.25$ cm

46.25 cm

(3)

---

76. Use approximations to estimate the value of

$$\frac{596.4 \times 2.06}{0.521}$$

$\approx \frac{600 \times 2}{0.5}$

2400

(3)

---

77. James has received two job offers.
A job in Milan which pays €55,000 a year.
A job in Boston which pays $64,000 a year.

The exchange rates were £1 = $1.42 and £1 = €1.25.

Which job offer has the highest salary?
Show working to explain your answer.

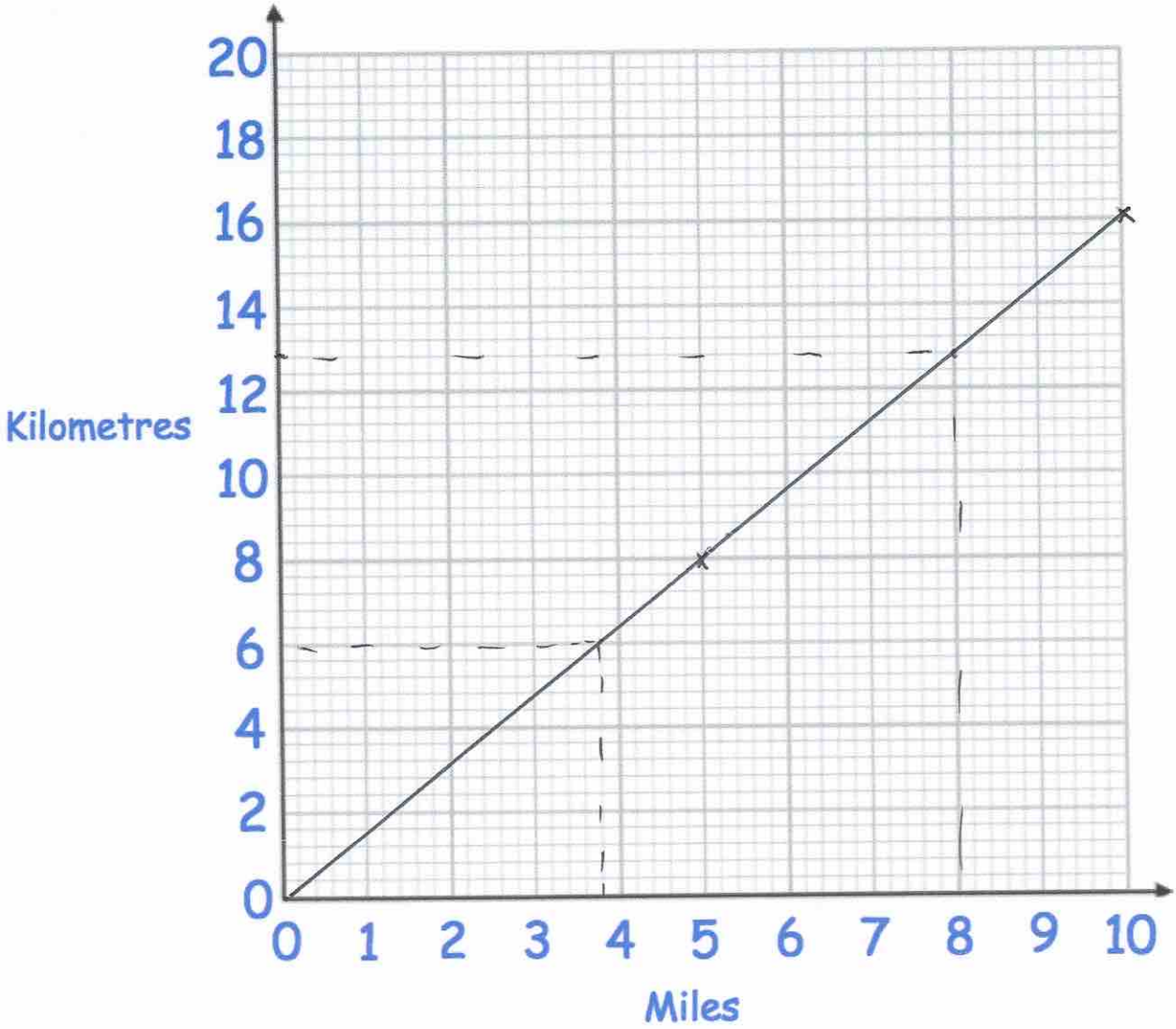
$55000 \div 1.25 = 44000$

$64000 \div 1.42 = 45070.42$

Boston

(3)

78 (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

12.8 .....km

(1)

(c) 6 kilometres to miles

3.8 .....miles

(1)

79. Simplify

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

$$\frac{a^{13/15}}{a^{3/5}}$$

$a^{4/15}$

.....

(2)

---

80. (a) Write 5930000000 in standard form.

5.93×10^9

.....

(1)

(b) Write 8.024×10^{-4} as an ordinary number.

0.0008024

.....

(1)

(c) $c = 2 \times 10^6$ and $y = 6 \times 10^5$

$$w^2 = \frac{cy}{c - y}$$

Work out the value of w.
Give your answer in standard form correct to 2 significant figures.

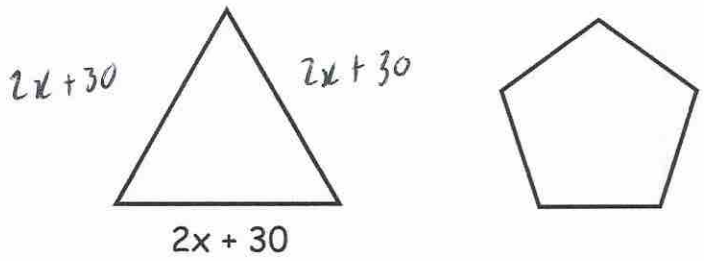
$$w^2 = \frac{12 \times 10^{11}}{1400}$$

$w = 925.82\ldots$ 930

.....

(3)

81. Here is an equilateral triangle and a regular pentagon.



The perimeter of the two shapes are equal.

Find an expression for the length of each side of the regular pentagon.

$\frac{6x + 90}{5}$

$1 \cdot 2x + 18$

.....

(4)

---

82. Factorise fully

$w^2y + wy^2$

$wy(w + y)$

.....

(2)

---

83. Solve

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

see Question 23

.....

(5)

84. $v = u + at$

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

$62 = 250 + 8a$

$8a = -188$

$a = -23.5$

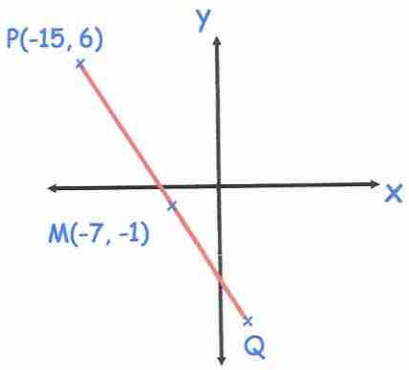
$a = -23.5$

(3)

---

85. M is the midpoint of PQ

Write down the coordinates of the point Q.

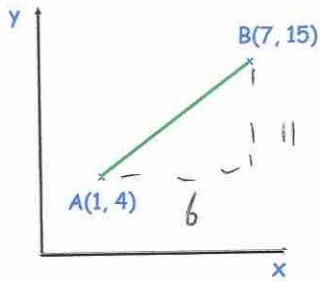


$(1, -8)$

(2)

---

86. Shown below are the points A(1, 4) and B(7, 15)



Calculate the length of the line joining A and B.

$6^2 + 11^2 = 157$

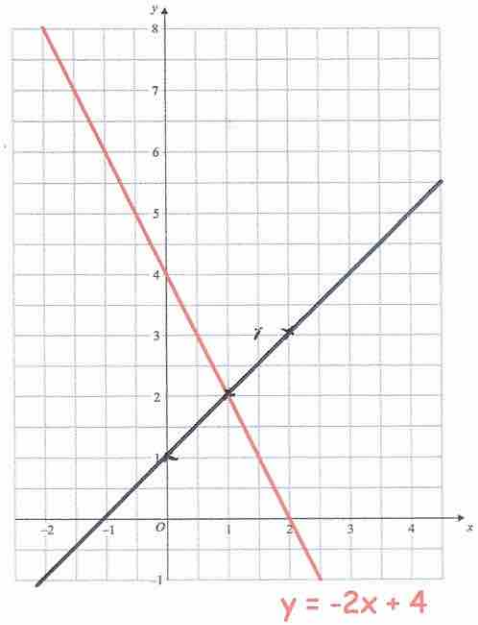
$\sqrt{157}$

12.53

to 2dp

(2)

87. The straight line $y = -2x + 4$ has been drawn on the grid.



(a) On the same grid, draw the graph of $y = x + 1$

(2)

(b) Use the graphs to solve the simultaneous equations

$$y = -2x + 4$$

$$y = x + 1$$

$x = 1$, $y = 2$

(2)

---

88. The front elevation of a solid shape is a circle.
The side elevation of the solid shape is a rectangle.
The plan view of the solid shape is a rectangle.

Write down the name of the shape.

Cylinder

(1)

---

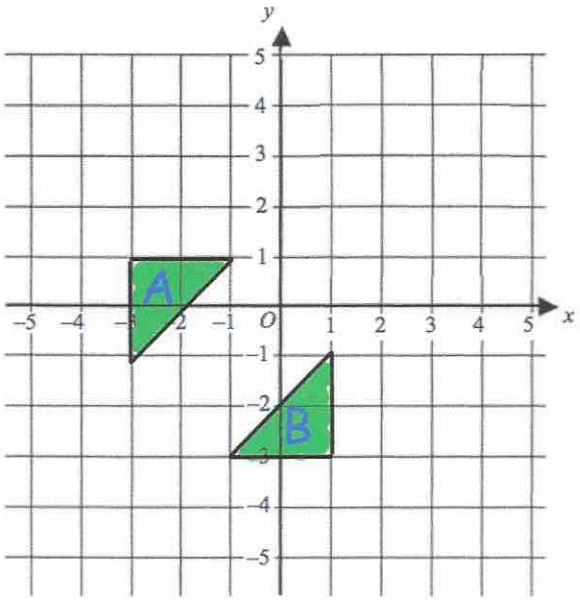
89. Convert 552 cm² into m²

$552 \div 100^2$

0.0552 m²

(1)

90.

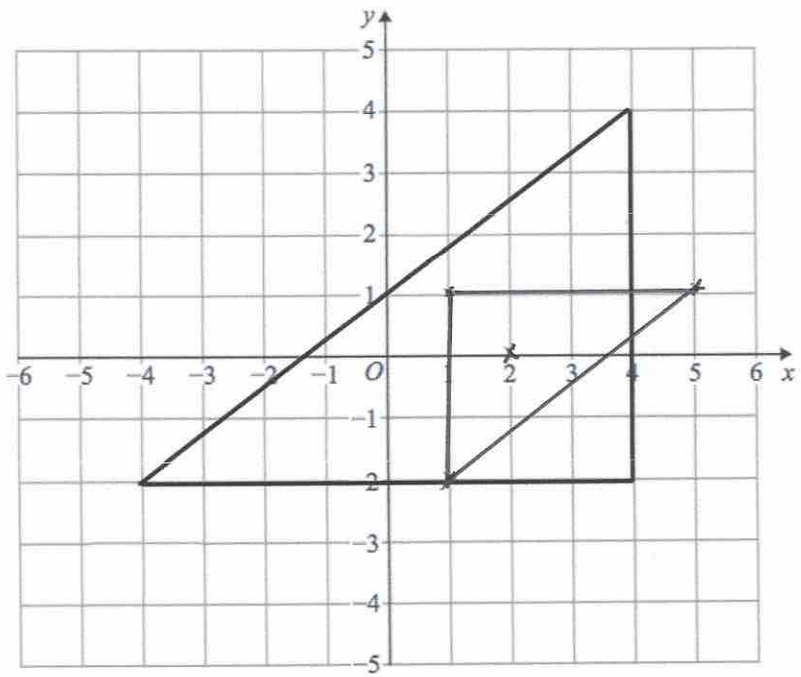


Describe fully the single transformation that maps triangle A onto triangle B.

Reflection in the line $y = x$

(2)

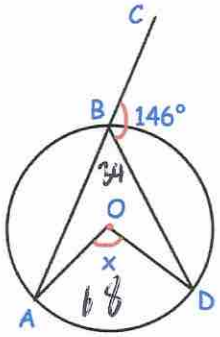
91.



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

(3)

92.



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

Find the size of angle AOD.

18 .....°

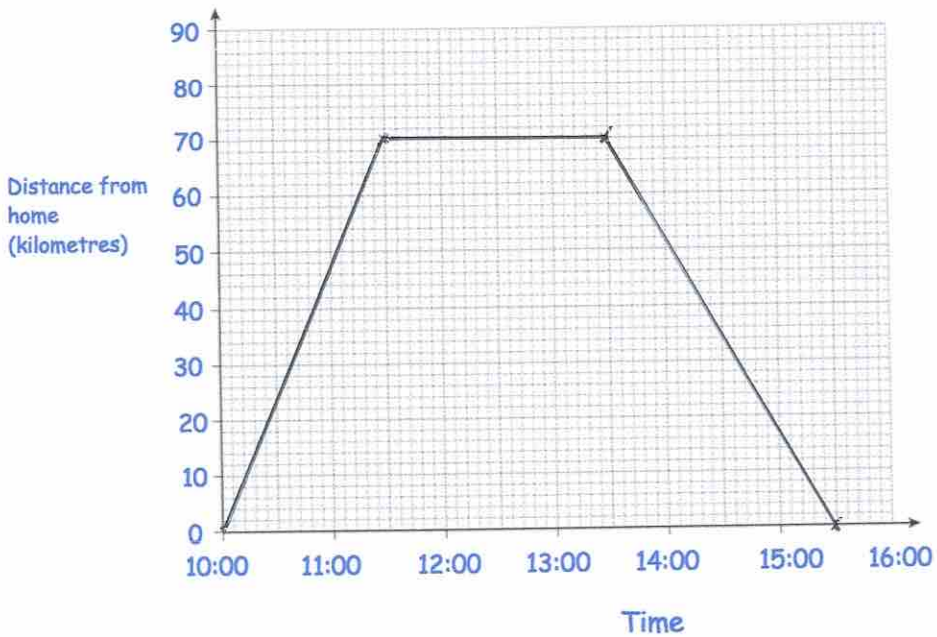
(3)

---

93. Bethany drove to a family meal and then back home.
The meal was at a restaurant that is 70 kilometres from her home.

Bethany left home at 10:00 and arrived at the restaurant at 11:30.
She stayed at the family meal for 2 hours.
Bethany then drove home at a speed of 35 kilometres per hour.

Show this information on the distance-time graph.



(3)

94. An object is placed on a table.
It exerts a force of 22 newtons on the table.

The pressure on the table is 500 newtons/m²

Calculate the area of the crate that is in contact with the table.
Include suitable units.

$A = \frac{F}{P}$

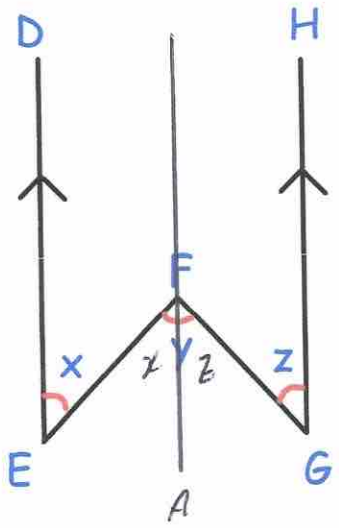
$\frac{22}{500} = 0.044 m^2$

$440 cm^2$
or
$0.044 m^2$

(3)

---

95. In the diagram below, the lines ED and GH are parallel.



Prove that x + z = y

$\angle DEF = \angle EFA$ } alternate angles are equal
$\angle HGF = \angle GFA$ }

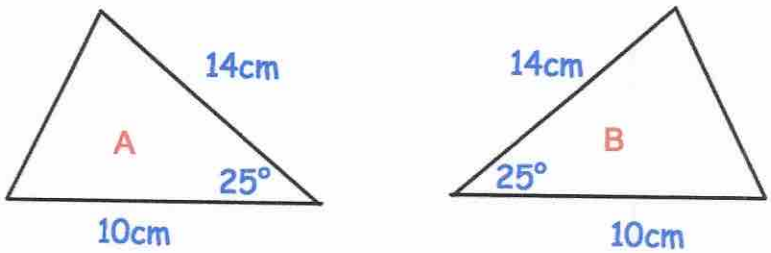
$\angle EFG = x + z$

$y = x + z$

(3)

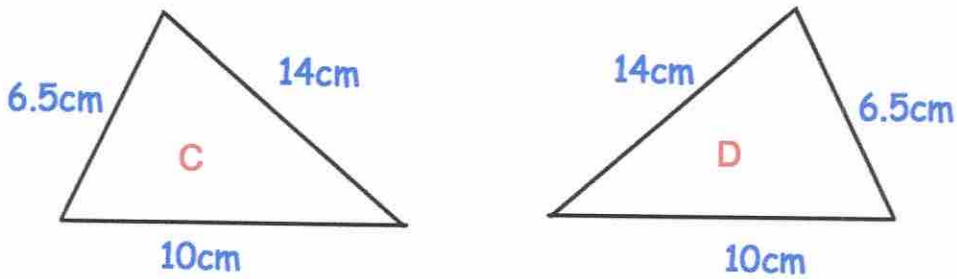
96. For each pair below, state the condition why they are congruent.

(a)



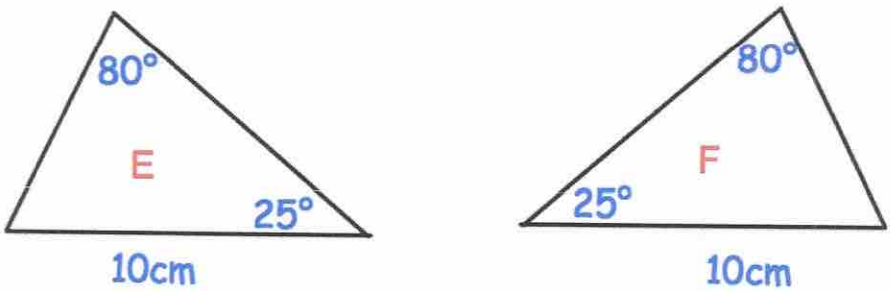
Condition: SAS
(1)

(b)



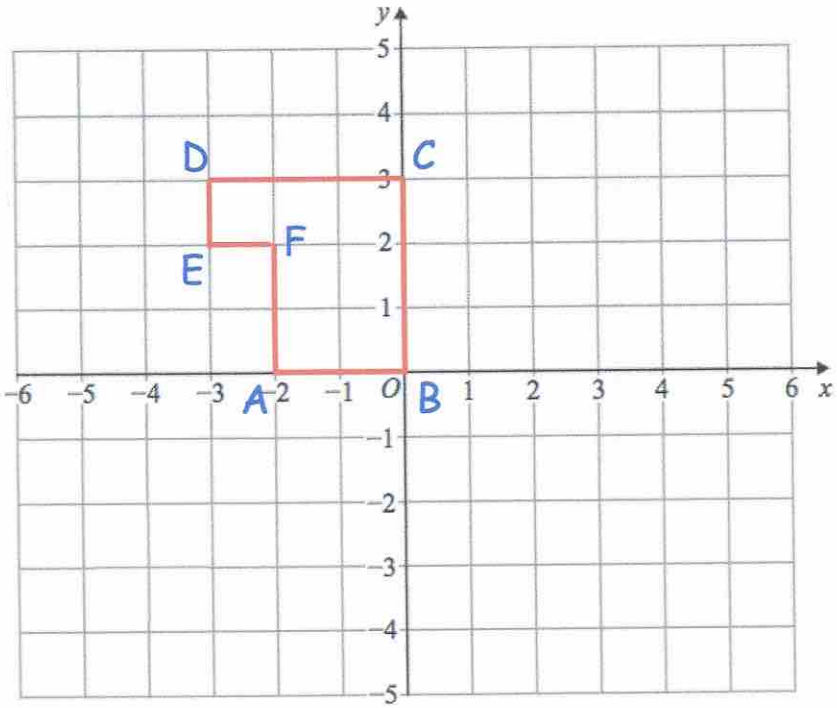
Condition: SSS
(1)

(c)



Condition: ASA
(1)

97. Here is shape ABCDEF



Describe fully a **single** transformation so that only vertex F is invariant.

Rotation of 180° about centre (-2, 2)

98. 5 Year 10 students and 45 Year 11 students sit a test.

The mean mark for the whole group is 70
The mean mark for the Year 11 students is 72

Work out the mean mark for the Year 10 students.

50 × 70 = 3500

45 × 72 = 3240

260

260 ÷ 5 = 52

52

(2)

99. A manager recorded how long each customer spent in his supermarket.
The table shows his results.

Time, t (minutes)	Frequency
$0 < t \leq 10$	24
$10 < t \leq 20$	31
$20 < t \leq 30$	50
$30 < t \leq 40$	35
$40 < t \leq 50$	60

$200/2 = 100^{th}$

or

$201/2 = 100.5^{th}$

Which class interval contains the median?

$20 < t \leq 30$

(1)

100. The table shows the number of pages in 100 books.

Number of pages, x	Frequency
$0 < x \leq 100$	7
$100 < x \leq 200$	25
$200 < x \leq 300$	40
$300 < x \leq 400$	12
$400 < x \leq 500$	16

Write down the modal class interval.

$200 < x \leq 300$

(1)

101. A biased coin is flipped twice.

The probability of the coin landing on tails is 0.7

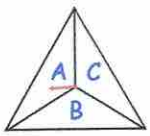
Find the probability the coin lands on heads twice.

$0.3 \times 0.3 = 0.09$

0.09

(2)

102 A three-sided spinner is labelled A, B and C.

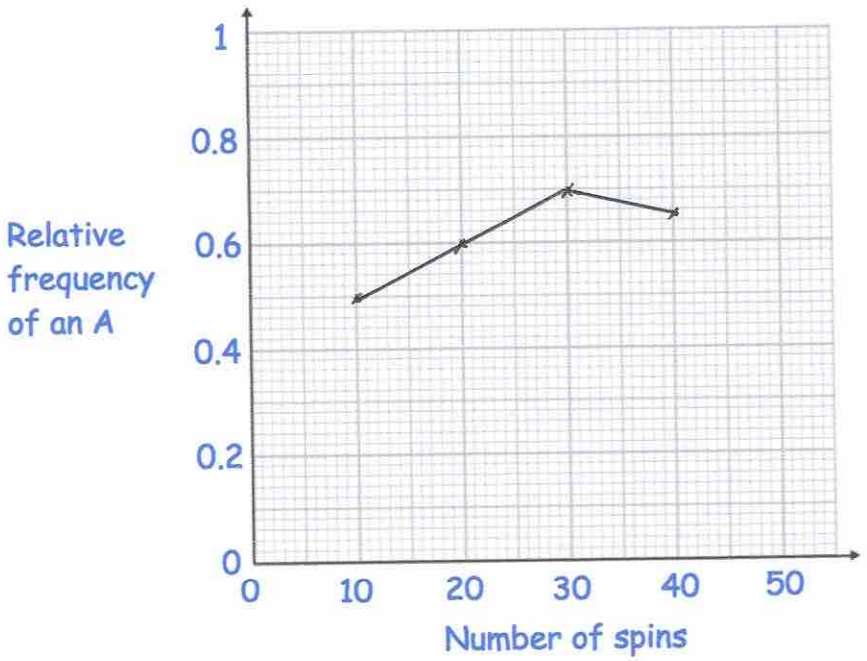


The spinner is spun and the frequency the letter A is recorded every 10 spins.
The table below shows this information.

Spins	10	20	30	40
Frequency of an A	5	12	21	26

$\frac{5}{10} = 0.5$ $\frac{12}{20} = 0.6$ $\frac{21}{30} = 0.7$ $\frac{26}{40} = 0.65$

(a) Complete plot the relative frequencies on the graph below.



(3)

(b) Neil says the relative frequency after 50 spins is 0.8
Explain why Neil must be wrong

$50 \times 0.8 = 40$, that would mean 14 more ...

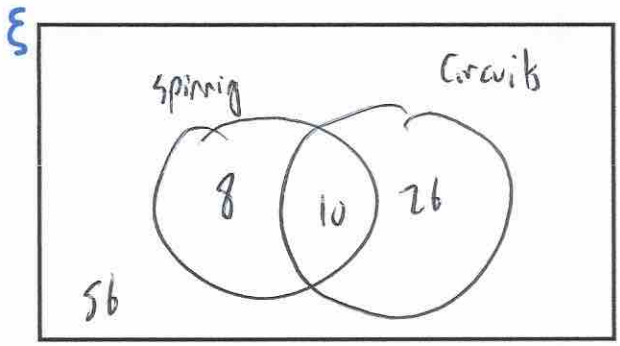
A in 10 spins - not possible.

(2)

103. A gym runs two fitness classes, spinning and circuits.

On Saturday 100 people visited the gym.
18 people attended the spinning class.
10 people attended both classes.
56 people did not attend either class.

(a) Represent this information on a Venn diagram



(3)

A person who attended the gym is selected at random.

Find the probability that this person

(b) attended only circuits

$100 - 56 - 8 - 10$

$\frac{26}{100} = \frac{13}{50}$

.....

(2)

(c) attended exactly one class

$8 + 26$

$\frac{34}{100} = \frac{17}{50}$

.....

(2)

(d) attended spinning, given that they attended circuits

$\frac{10}{36} = \frac{5}{18}$

.....

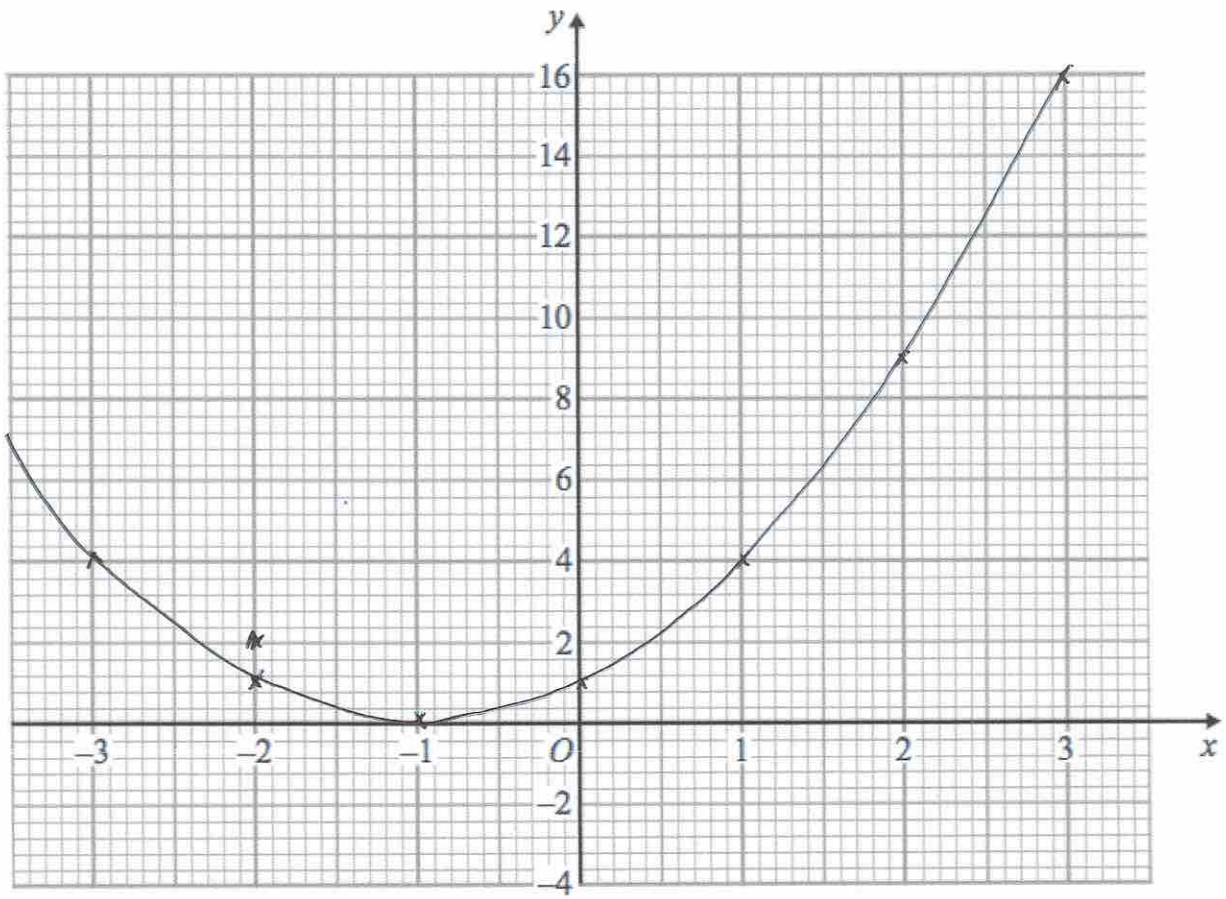
(2)

104. (a) Complete the table of values for $y = x^2 + 2x + 1$

x	-3	-2	-1	0	1	2	3
y	4	1	0	1	4	9	16

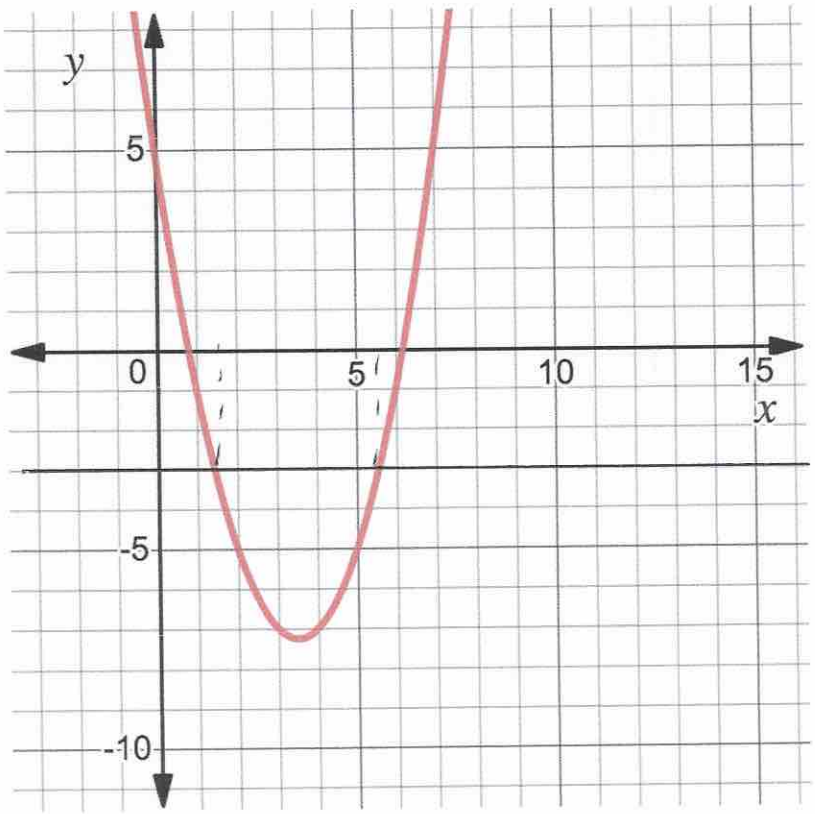
(2)

(b) On the grid, draw the graph of $y = x^2 + 2x + 1$ for the values of x from -3 to 3.



(2)

105. Shown below is the graph of $y = x^2 - 7x + 5$



Use the graph to find estimates of the solutions of the equation
$x^2 - 7x + 5 = -3$

x = 1·5 and x = 5·5

(2)

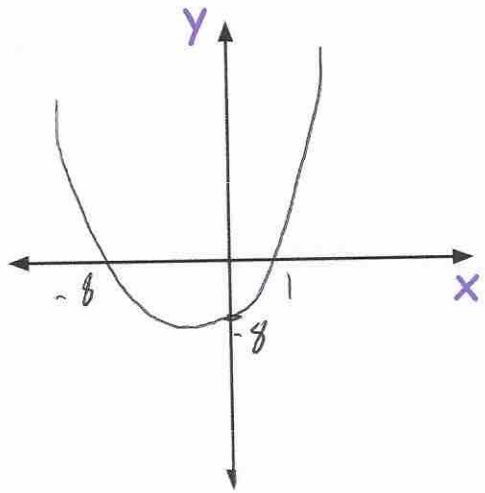
06 Sketch the graph of $y = x^2 + 7x - 8$

$0 = (x+8)(x-1)$

$x = -8 \quad x = 1$

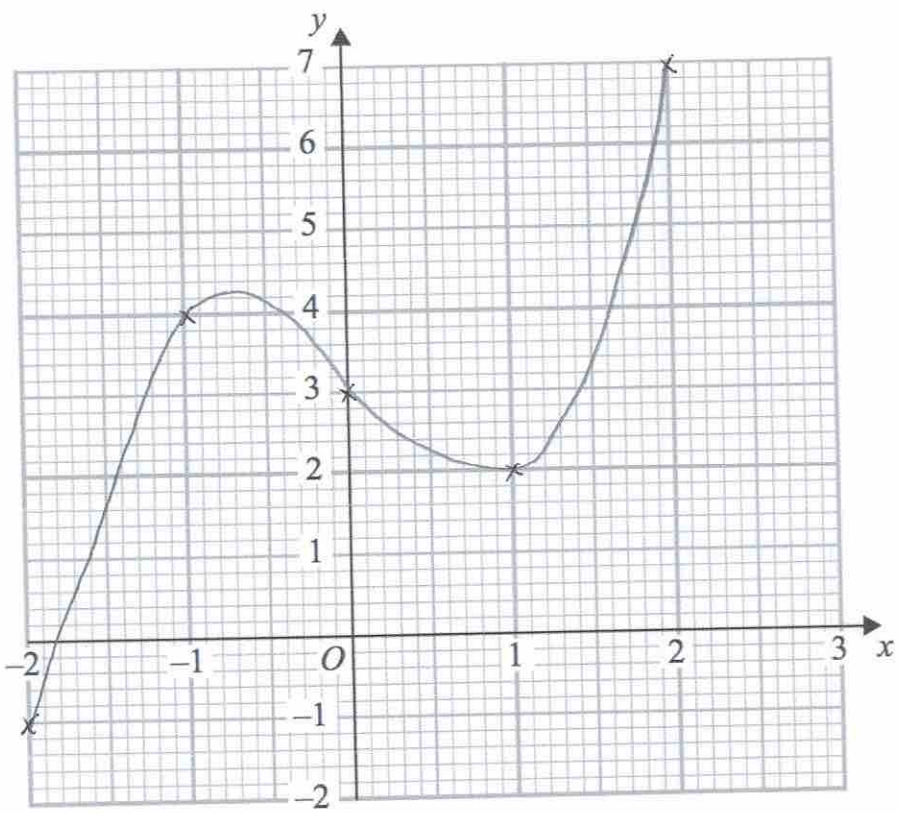
$y = 0^2 + 0 - 8$

$y = -8$



(3)

07 On the grid, draw the graph of $y = x^3 - 2x + 3$ for the values of x, $-2 \leq x \leq 2$



x	-2	-1	0	1	2
y	-1	4	3	2	7

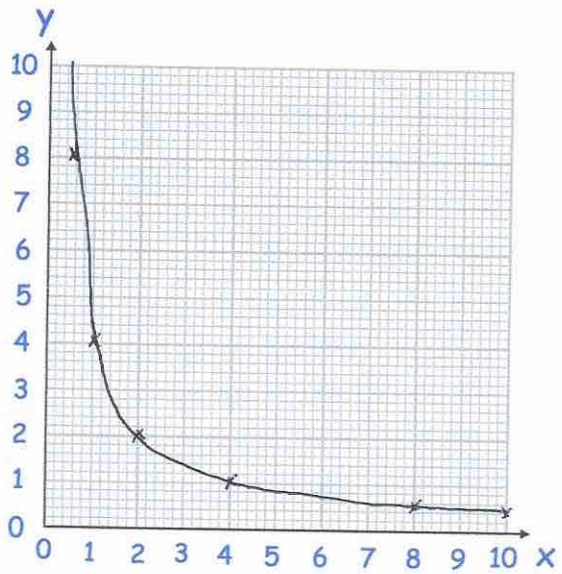
(2)

108. (a) Complete the table of value for $y = \frac{4}{x}$

x	0.5	1	2	4	8	10
y	8	4	2	1	0.5	0.4

(2)

(b) On the grid, draw the graph of $y = \frac{4}{x}$ for $0.5 \leq x \leq 10$



(2)

109. $9x^3 + (x + a)(x + b) + cx \equiv ax^3 + x^3 + x^2 + 12x - 24$

Work out the values of a, b and c.

$9x^3 + x^2 + ax + bx + ab + cx \equiv ax^3 + x^2 + 12x - 24$

x^3 $a = a + 1$

$a = 8$

constants $ab = -24$

$b = -3$

x $b + a + c = 12$

$b + c = 4$

$c = 7$

a = 8

b = −3

c = 7

(3)