Paper 5 and Paper 6 Preparation Paper

OCR 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 5 and 6 Checklist

Question	Topic	Video number
Seen Topics (remember they may still appear, so they may be worthwhile recapping)		
See website	Use of a Calculator	352
See website	Product of Primes	223, 224
See website	Standard Form	300 to 303
See website	Quadratic nth Term	388
See website	Graphical Inequalities	182
See website	Non-Linear Simultaneous Equations	298
See website	Circle Theorems	64, 65
See website	Column Vectors	353a
See website	Pie Charts	163, 164
See website	Drawing Histograms	157
See website	Box Plots	149
See website	Tree Diagrams	252

1. Hannah is baking two cakes.

One cake needs 1⅓ cups of milk. $4/3$
Hannah has 1¼ cups of milk. $5/4$

How much more milk does Hannah need?

$\frac{4}{3} \times 2 = \frac{8}{3}$

$\frac{8}{3} - \frac{5}{4}$

$\frac{32}{12} - \frac{15}{12} = \frac{17}{12}$

$1\frac{5}{12}$

.....cups
(3)

2. Work out

$$1\frac{1}{3} \times 2\frac{2}{5}$$

Give your answer as a mixed number.

$\frac{4}{3} \times \frac{12}{5} = \frac{48}{15}$

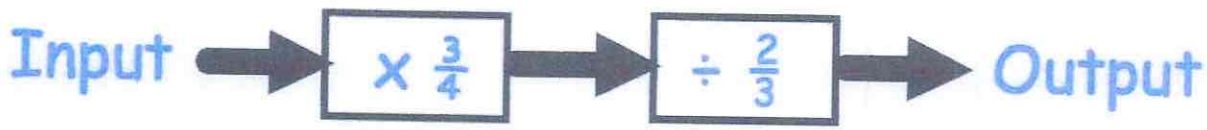
$= 3\frac{3}{15}$

$3\frac{1}{5}$

.....

(3)

3.



(a) Find the output, if the input is 2.

$\frac{2}{1} \times \frac{3}{4} = \frac{6}{4} = \frac{3}{2}$

$\frac{3}{2} \div \frac{2}{3} \rightarrow \frac{3}{2} \times \frac{3}{2} = \frac{9}{4}$

$\frac{9}{4}$

.....

(3)

(b) Find the input, if the output is ½

$\frac{1}{2} \times \frac{2}{3} = \frac{2}{6} = \frac{1}{3}$

$\frac{1}{3} \div \frac{3}{4} \Rightarrow \frac{1}{3} \times \frac{4}{3}$

$\frac{4}{9}$

.....

(3)

4. Work out 0.017×0.45

$$\begin{array}{r} 45 \\ \times 17 \\ \hline 315 \\ 450 \\ + \\ \hline 765 \end{array}$$

0.00765

(2)

5. 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 tin is best value.

(4)

6. 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.

Milan 55000 ÷ 1.25 = £44000

Boston 64000 ÷ 1.42 = £45070.42

Boston

(3)

---

7. Write down the reciprocal of 0.35

$0.35 = \frac{7}{20}$

$\frac{7}{20} \rightarrow \frac{20}{7}$

$\frac{20}{7}$

(1)

---

8. Use approximations to estimate the value of

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

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

$= \frac{1200}{0.5}$

2400

(3)

9. (a) Write 32 in the form 4^n

$4^{5/2}$

.....

(2)

(b) Write $\frac{1}{8}$ in the form 2^n

2^{-3}

.....

(2)

---

10. 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)

---

11. 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.

$1500 \div 100 = 15$

$15 \times 2.5 = 37.50$

$37.50 \times 4 = 150$

$1500 + 150$

£ 1650

(3)

12. 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)

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

$x = 0.309090909...$

$10x = 3.090909...$

$1000x = 309.0909...$

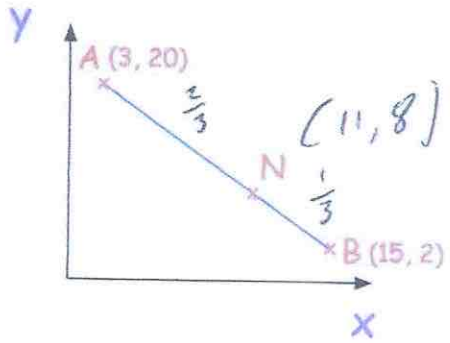
$990x = 306$

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

$= \frac{17}{55}$ ✓

(3)

14 A is the point with coordinates (3, 20)
B is the point with coordinates (15, 2)
N is a point of the line AB such that AN : NB = 2 : 1



Find the coordinates of the point N.

15 − 3 = 12

2/3 of 12 = 8

x coordinate is 3 + 8 = 11

y - coordinate:

2 − 20 = −18

2/3 of −18 = −12

20 − 12 = 8

(11, 8)

.....

(3)

15 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.

$5 = \frac{d}{t}$ $\frac{205}{26.15} = 7.839388...$

7.839

..... m/s

(2)

16. Jacob picks a 5-digit **even** number.

The first digit is a prime number. 2 3 5 7
The third digit is odd.
The fourth digit is 8

How many different 5-digit number could he pick?

1st 2nd 3rd 4th 5th

4 x 10 x 5 x 1 x 5 = 1000

1000

(3)

---

17. 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)

---

18. 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

(4)

19. 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)

---

20. 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?

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

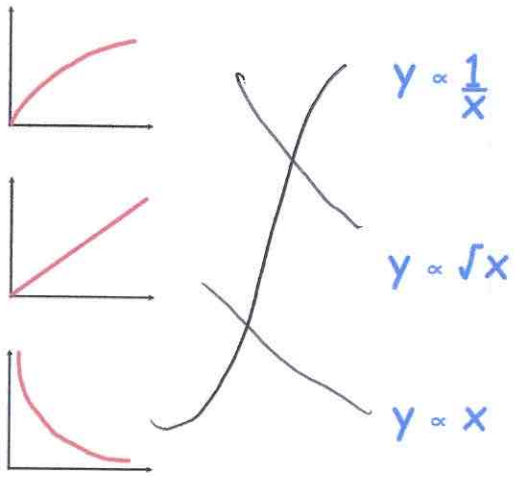
$s^2 = 50$

$s = 7.07\ldots$

8

(3)

21. Match each graph to the correct relationship.



(3)

---

22. Make v the subject of the formula.

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

$2s = (u+v)t$

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

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

(3)

---

23. 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 hour.

$90 \times 3 = 270$ for 1 worker

$270 \div 10 = 27$

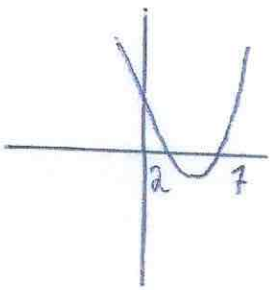
27 hrs

(3)

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

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

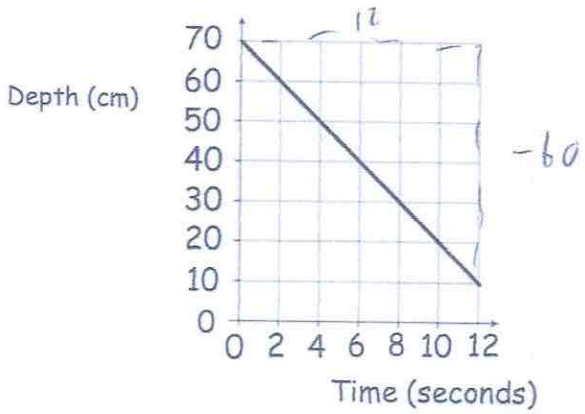
$x = 2 \quad x = 7$



$2 \leq x \leq 7$

(3)

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



(a) Write down the gradient of the line

$\frac{-60}{12}$

-5

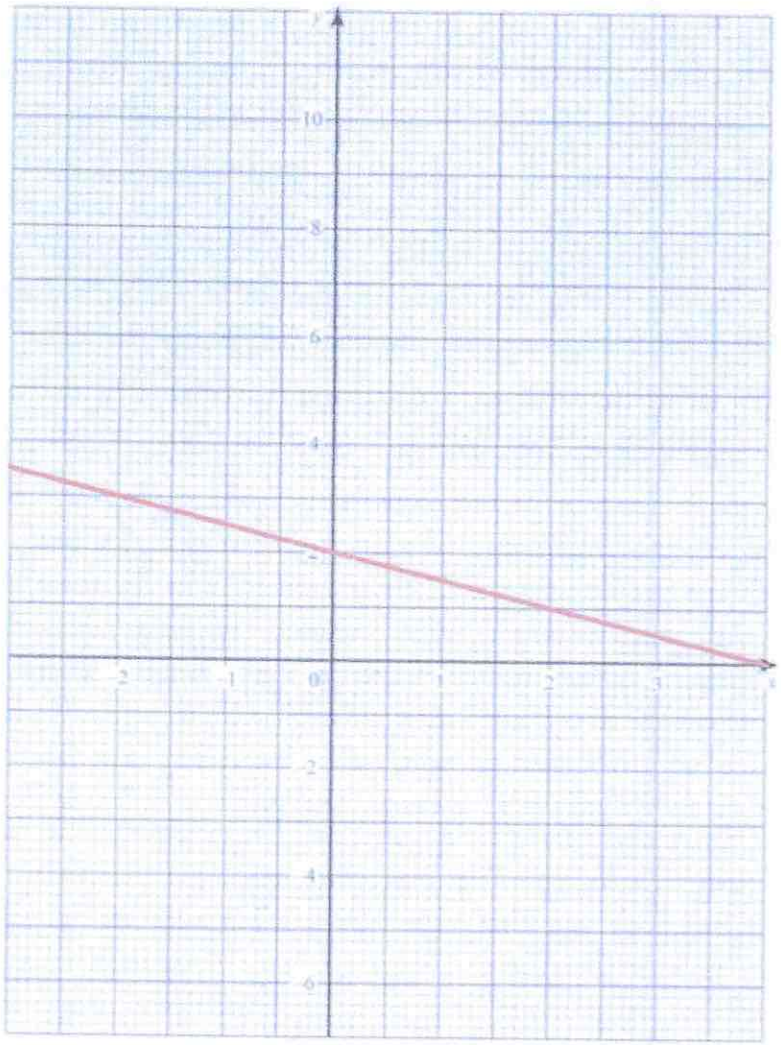
(1)

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

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

(1)

26



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)

27. (a) Rationalise the denominator of

$\frac{12}{\sqrt{3}} \times \sqrt{3}$

$\frac{12\sqrt{3}}{3}$

$4\sqrt{3}$

(2)

(b) Evaluate $\sqrt{2} \times \sqrt{32}$

$\sqrt{64}$

8

(2)

(c) Expand and simplify $(\sqrt{3} + \sqrt{5})^2$

$(\sqrt{3} + \sqrt{5})(\sqrt{3} + \sqrt{5})$

$3 + \sqrt{15} + \sqrt{15} + 5$

$8 + 2\sqrt{15}$

(2)

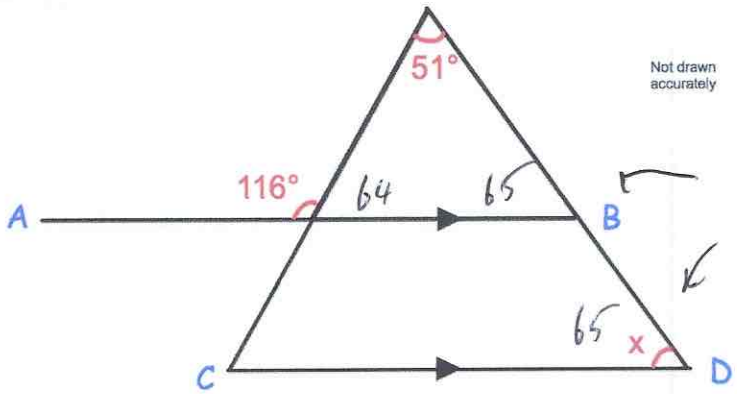
(d) Evaluate $(5 + \sqrt{2})(5 - \sqrt{2})$

$25 - 5\sqrt{2} + 5\sqrt{2} - 2$

23

(2)

28. In the diagram, AB is parallel to CD.



Corresponding angles

Work out the size of angle x.

You **must** show your workings.

180 - 116 = 64

51 + 64 = 115

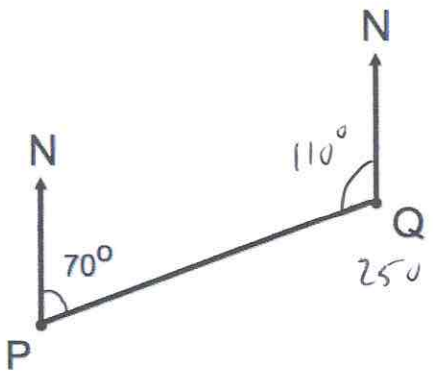
180 - 115 = 65

65 .....°

(4)

---

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



Not drawn accurately

The bearing of Q from P is 070°.

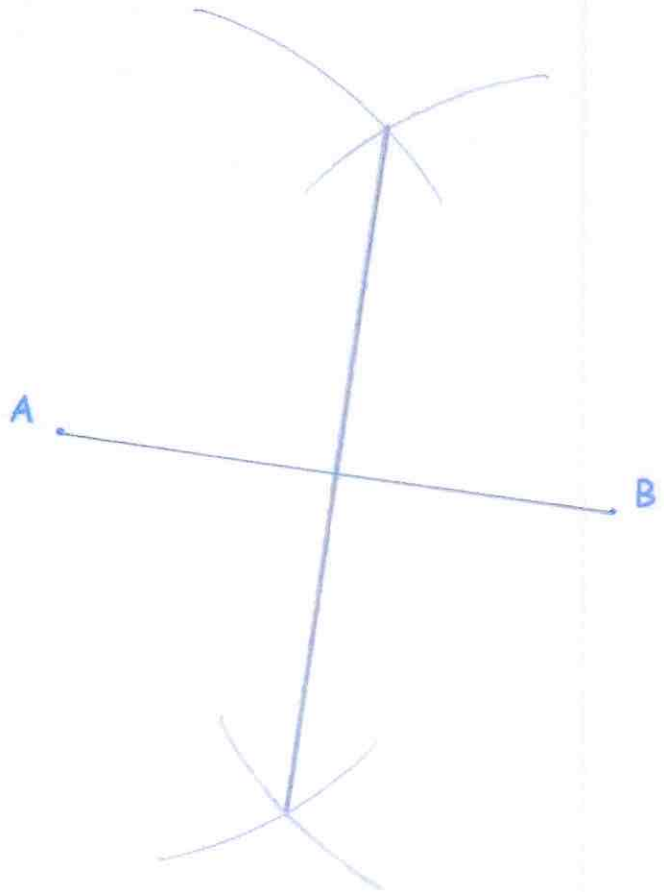
Calculate the bearing of P from Q.

360 - 110°

250 .....°

(2)

30 Use ruler and compasses to construct the perpendicular bisector of AB.
You **must** show clearly all your construction arcs.



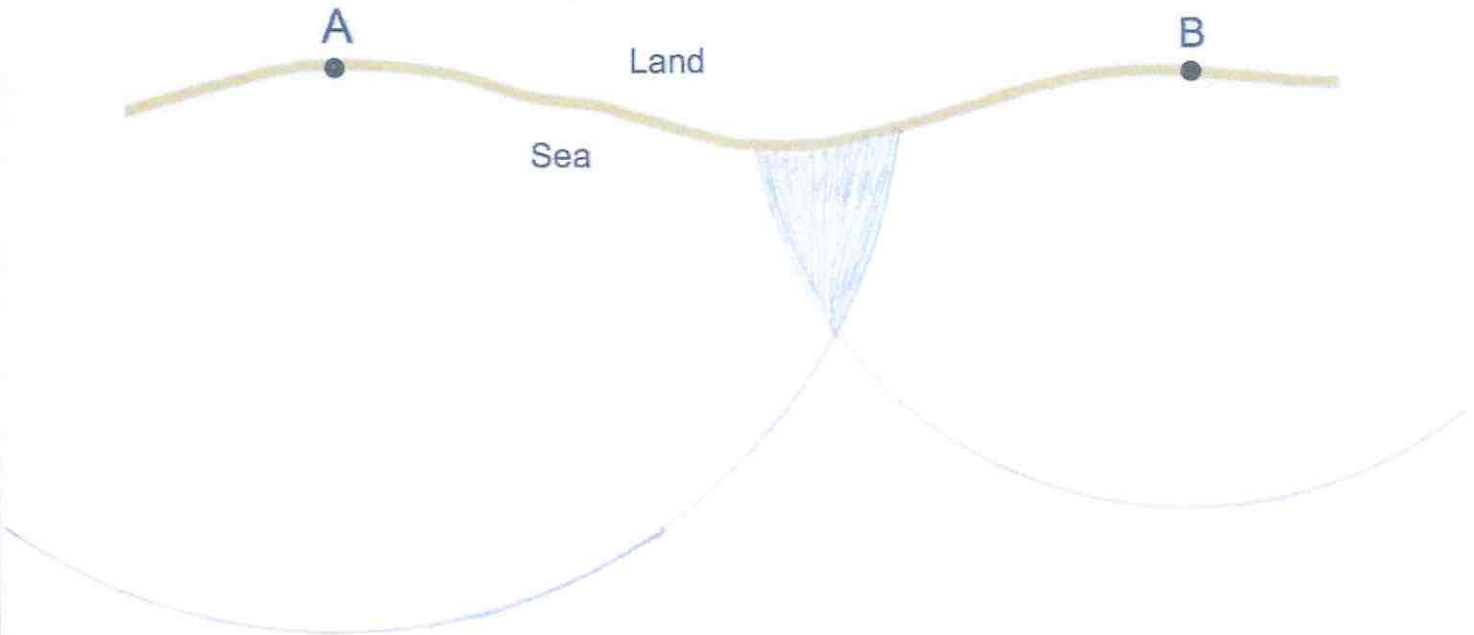
(2)

3 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.

1cm = 1 mile



(2)

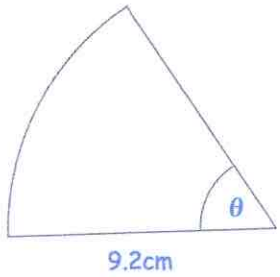
32. The front elevation of a solid shape is a circle.
The side elevation of the solid shape is a rectangle.
The plan view of the solid shape is a rectangle.

Write down the name of the shape.

Cylinder
.....
(1)

---

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



The area of the sector is 38.4cm²

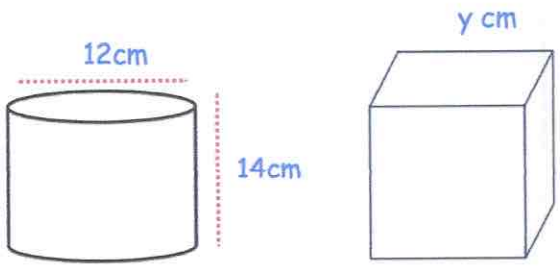
Find the size of angle θ
Give your answer to 2 significant figures.

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

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

52
.....°
(3)

34.



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.

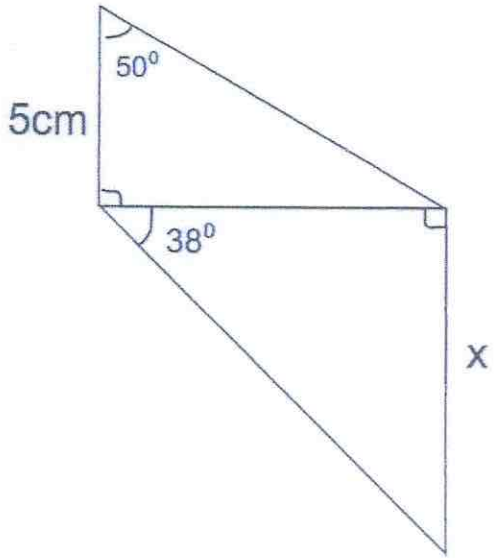
Cylinder $\pi \times 6^2 \times 14$

$= 1583.3626\ldots\ cm^3$

$\sqrt[3]{1583.36\ldots}$

11.66
..... cm
(4)

35 The diagram shows two right-angled triangles.



Calculate the value of x.

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

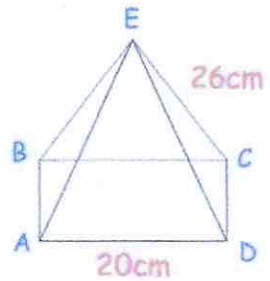
$= 5.9587$

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

4.655 .....cm

(5)

36 Shown below is a square based pyramid.
The apex E is directly over the centre of the base.



AD = 20cm
CE = 26cm

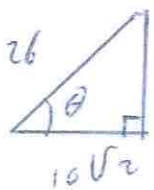
(a) Work out the length of AC

$20^2 + 20^2 = 800$

$AC = \sqrt{800}$
$= 20\sqrt{2}$

28.3 cm
to 1dp (2)

(b) Calculate angle CAE



$\cos\theta = \frac{10\sqrt{2}}{26}$

$\theta = 57.0485$

57.05 °
to 2dp (2)

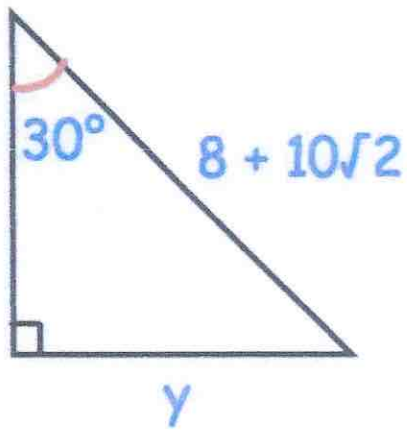
(c) Work out the height of the pyramid

$26^2 - (10\sqrt{2})^2$
$= 476$

$\sqrt{476} = 21.817$

21.82 cm
to 2dp (2)

37. Shown below is a right angled triangle.



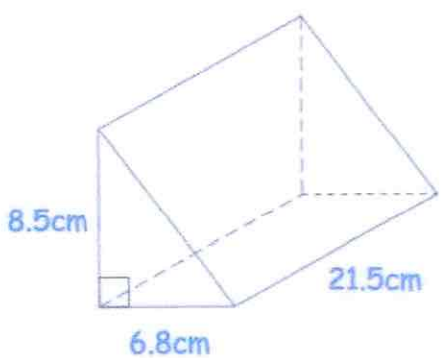
Find the exact length of the side labelled y.

$\sin(30) \times (8 + 10\sqrt{2})$

$4 + 5\sqrt{2}$

(4)

38. Shown below is a triangular prism.



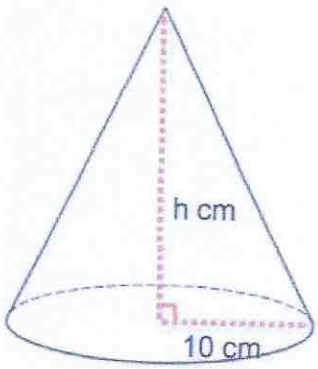
Find the volume of the triangular prism.

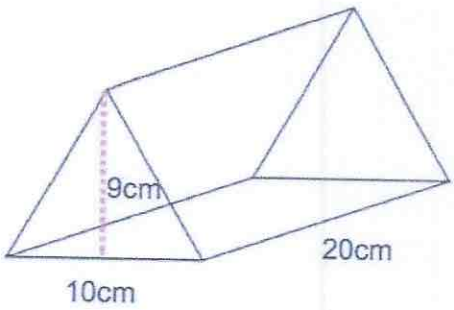
$V = \frac{1}{2} \times 6.8 \times 8.5 \times 21.5$

621.35 cm³

(3)

39. Shown is a cone and a triangular prism.





Both solids have the same volume.

Calculate the height of the cone.

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

$= 900\text{cm}^3$

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

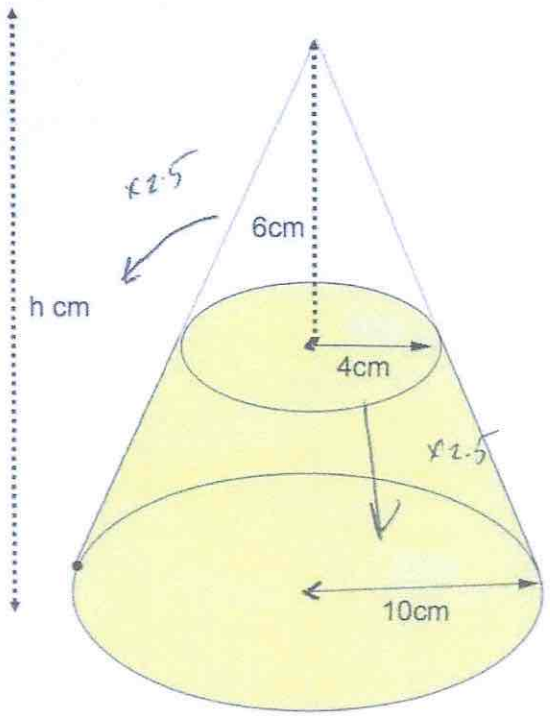
$h = 8.59\ldots$

8.6

.....cm

(3)

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

$500\pi - 32\pi = 1470.265\ldots$ 1470.3 ..... cm³

(5)

41 A cube has a volume of 343cm³

Work out the surface area of the cube.

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

$7 \times 7 = 49$

$49 \times 6 = 294$

294 ..... cm²

(2)

42. A sphere has a radius of 5cm.

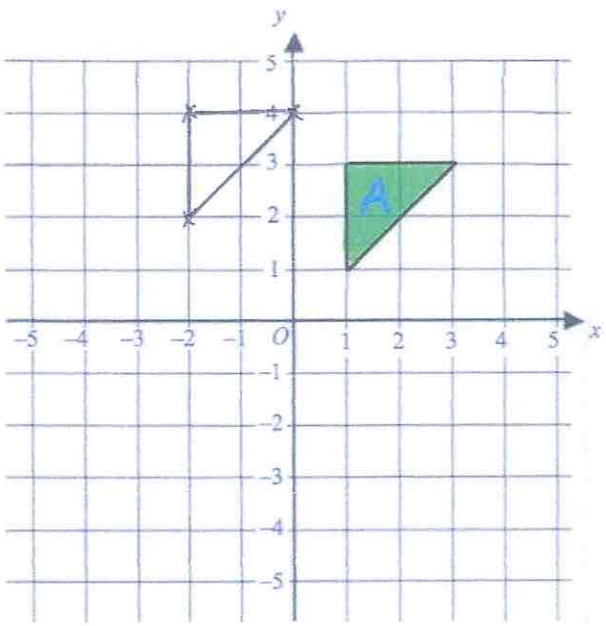
Calculate the surface area of the sphere.

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

$314.16 cm^2$

(3)

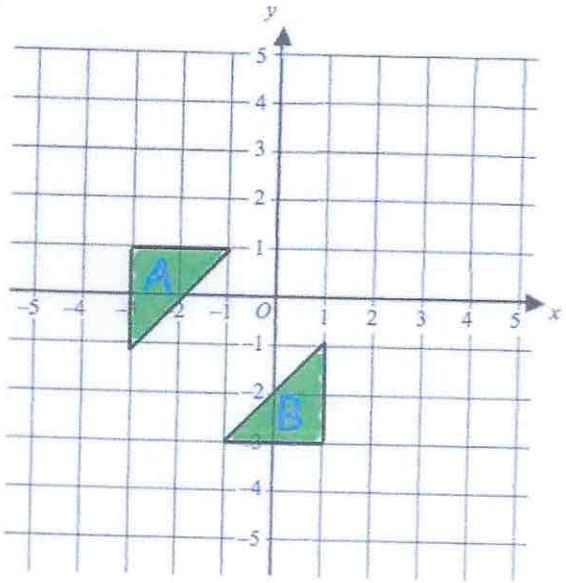
43.



Translate triangle A by the vector $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$

(2)

44.

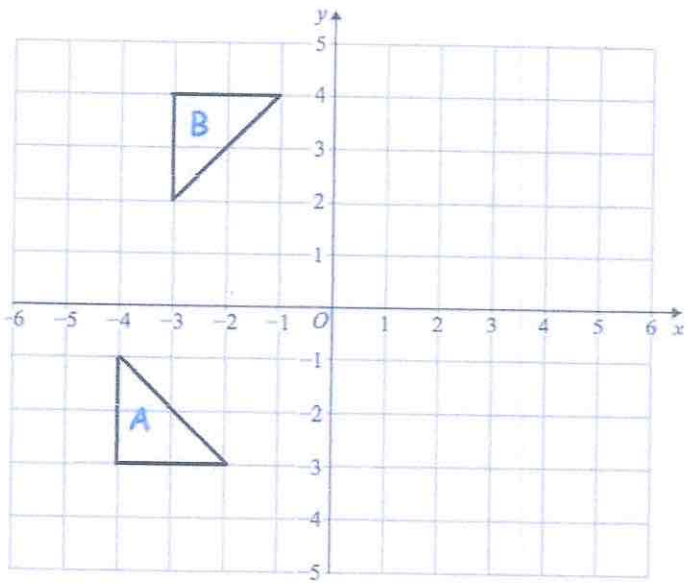


Describe fully the single transformation that maps triangle A onto triangle B.

Reflection in the line $y = x$

(2)

45.

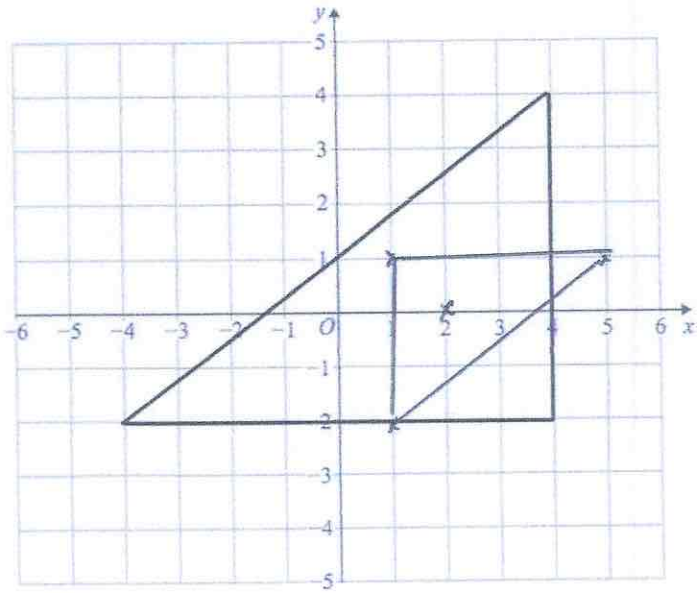


Describe fully the single transformation that maps triangle A onto triangle B.

Rotation 90° clockwise about (0, 0)

(2)

46



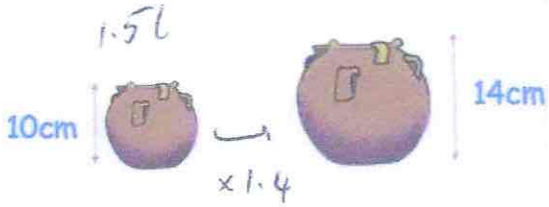
Enlarge the triangle by scale factor –½, using centre of enlargement (2, 0)

(3)

47 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)

48. 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)

---

49. Factorise fully

$w^2y + wy^2$

$wy(w + y)$

(2)

---

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

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

(2)

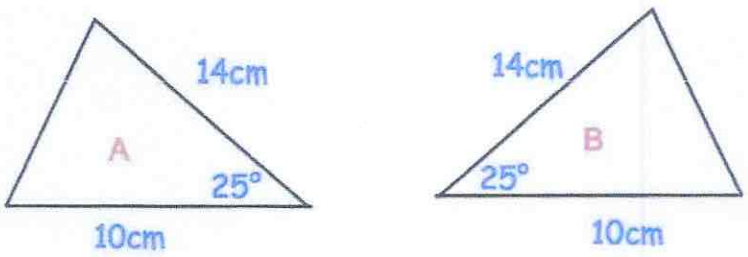
(b) Factorise $2w^2 - 9w + 4$

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

(2)

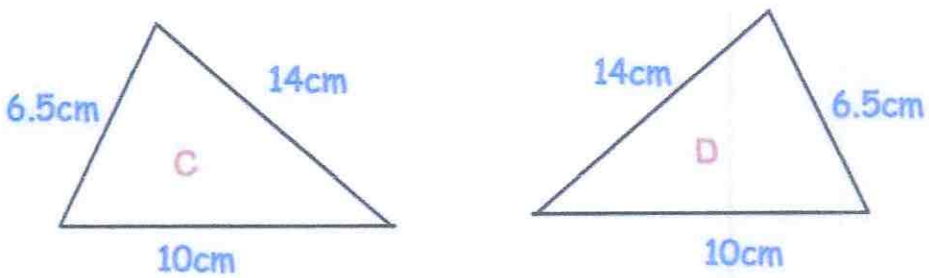
5 . For each pair below, state the condition why they are congruent.

(a)



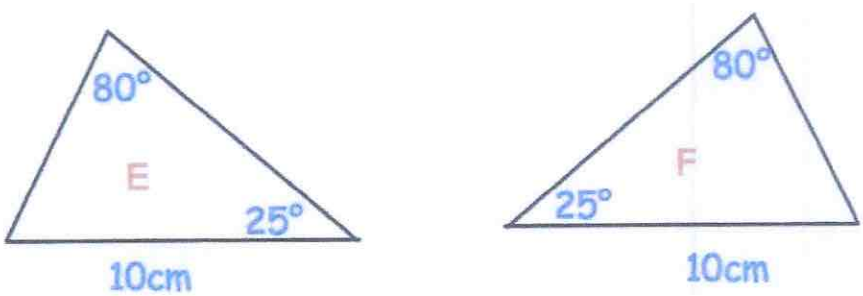
Condition: SAS
(1)

(b)



Condition: SSS
(1)

(c)



Condition: ASA
(1)

52. $v = u + at$

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

$62 = 250 + 8 \times a$

$62 = 250 + 8a$

$-188 = 8a$

$a = -23.5$

.....

(3)

53. 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.

0.3×0.3

0.09

.....

(2)

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

Mass	Frequency
$20 < m \leq 25$	12
$25 < m \leq 30$	24
$30 < m \leq 35$	17
$35 < m \leq 40$	15
$40 < m \leq 45$	4

72

midpoint	fx
22.5	270
27.5	660
32.5	552.5
37.5	562.5
42.5	170
	2215

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

$2215 \div 72$

30.764 .....grams

to 3dp

(4)

55. 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.

$50 \times 70 = 3500$

$45 \times 72 = 3240$

$260 \div 5 = 52$

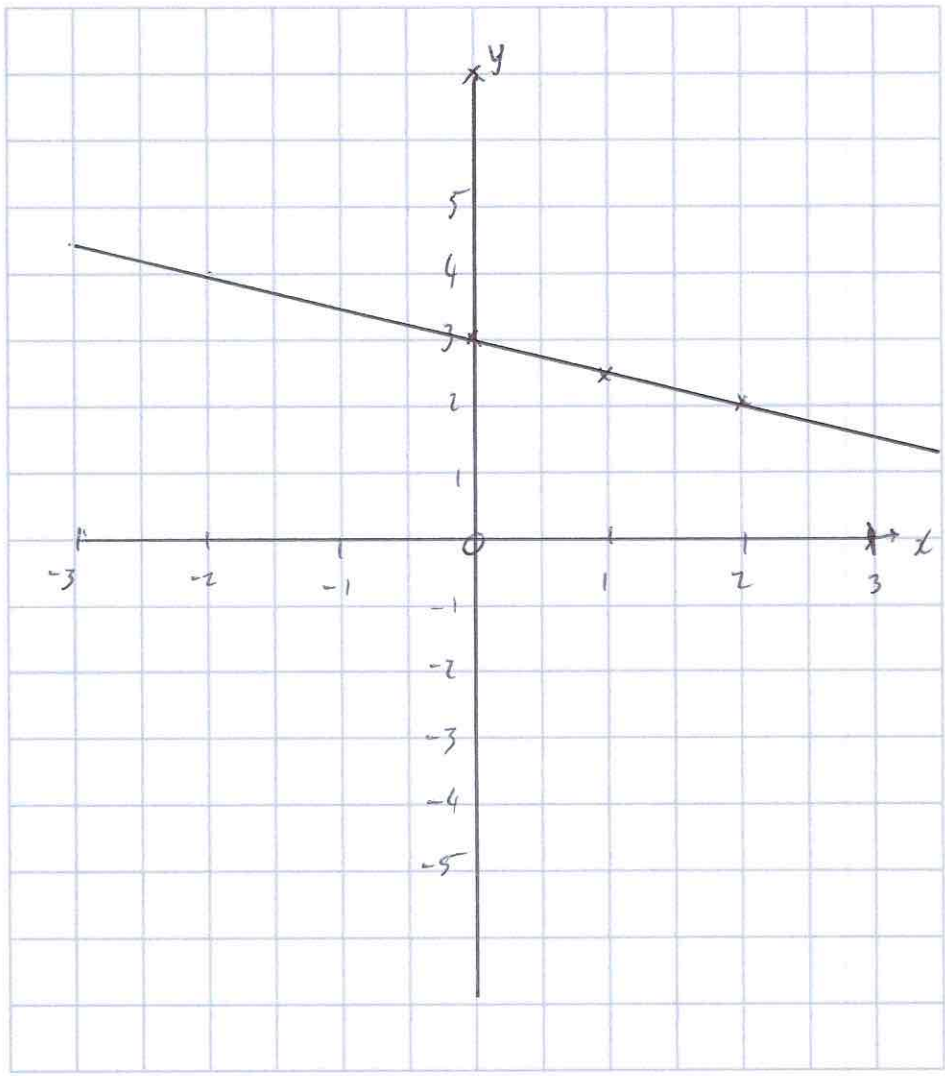
$3500 - 3240 = 260$

52

(2)

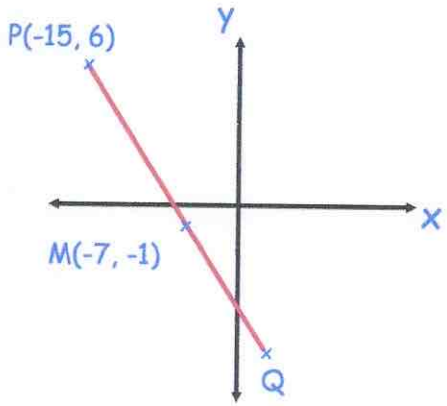
56. On the grid, draw $x + 2y = 6$ for values of x from –2 to 2.

x	0	1	2
y	3	2.5	2



(4)

57.



M is the midpoint of PQ

Write down the coordinates of the point Q.

(1, -8)

.....

(2)

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

Calculate the number of sides the polygon has.

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

$n - 2 = 41$

$n = 43$

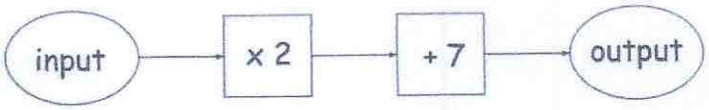
43

.....

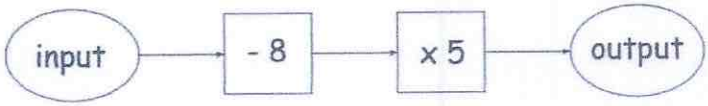
(2)

59. Here are two functions.

Function A

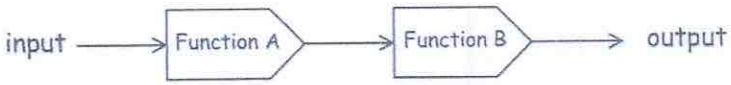


Function B



Composite function C is shown below.

Function C



The output of function C is –25

Work out the input.

$-25 \div 5 = -5$

$-5 + 8 = 3$

$3 - 7 = -4$

$-4 \div 2 = -2$

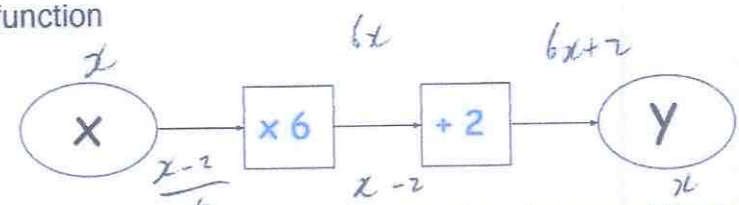
-2

.....

(2)

---

60. Here is a function



Find an algebraic expression for the output of the inverse of the function when the input is x.

$\frac{x-2}{6}$

.....

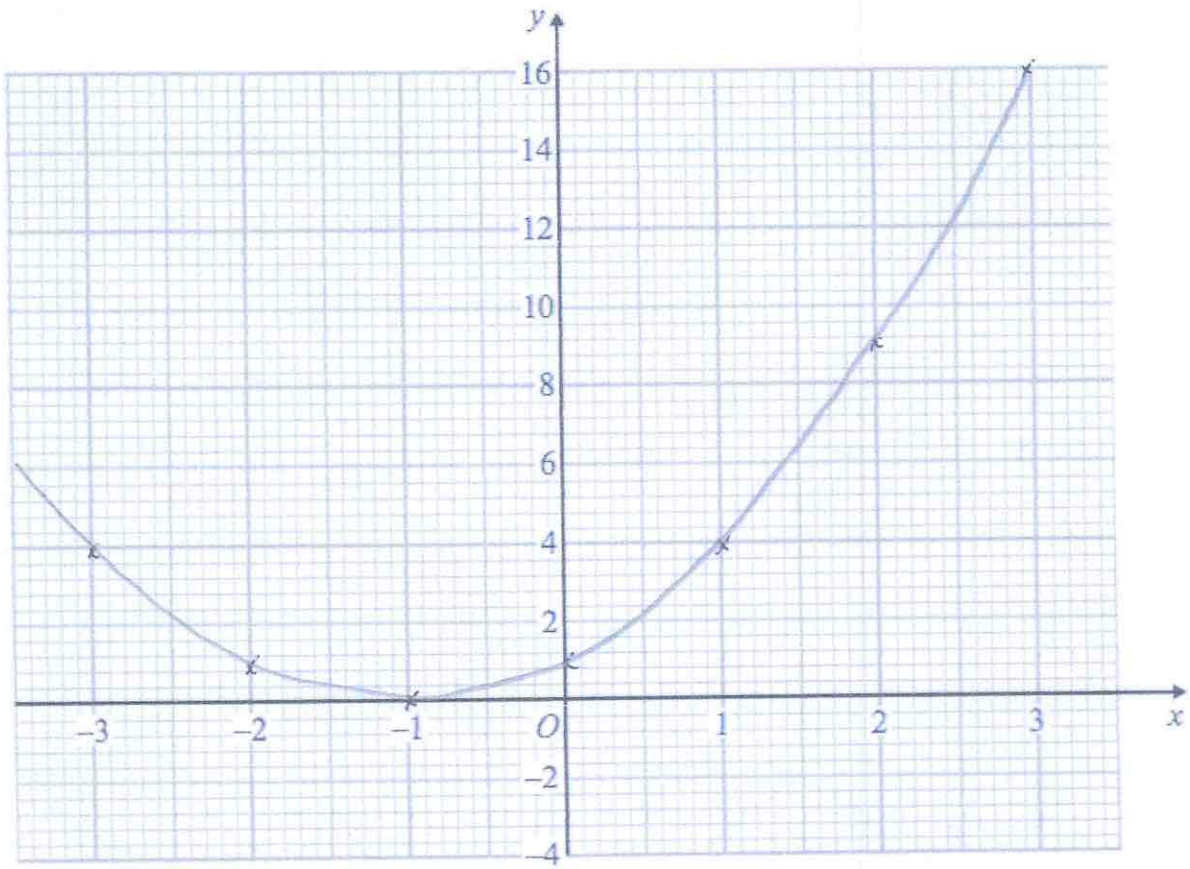
(2)

6 (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

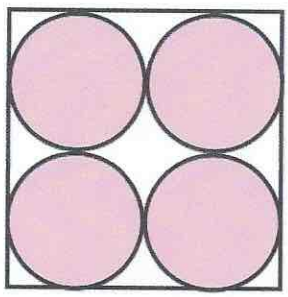
(2)

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



(2)

62. 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.

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

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

$16 \times 16 = 256$

$256 - 201.0619...$

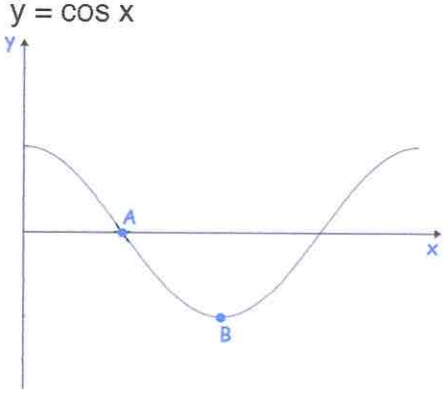
54.94

.....cm²

(5)

---

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



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

(90 , 0)

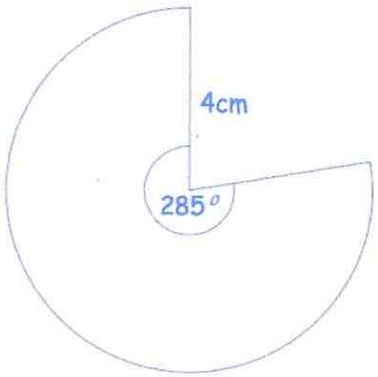
(1)

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

(180 , -1)

(1)

64.



Calculate the perimeter of the sector.

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

$19.896... + 4 + 4$

27.897

.....cm

(3)

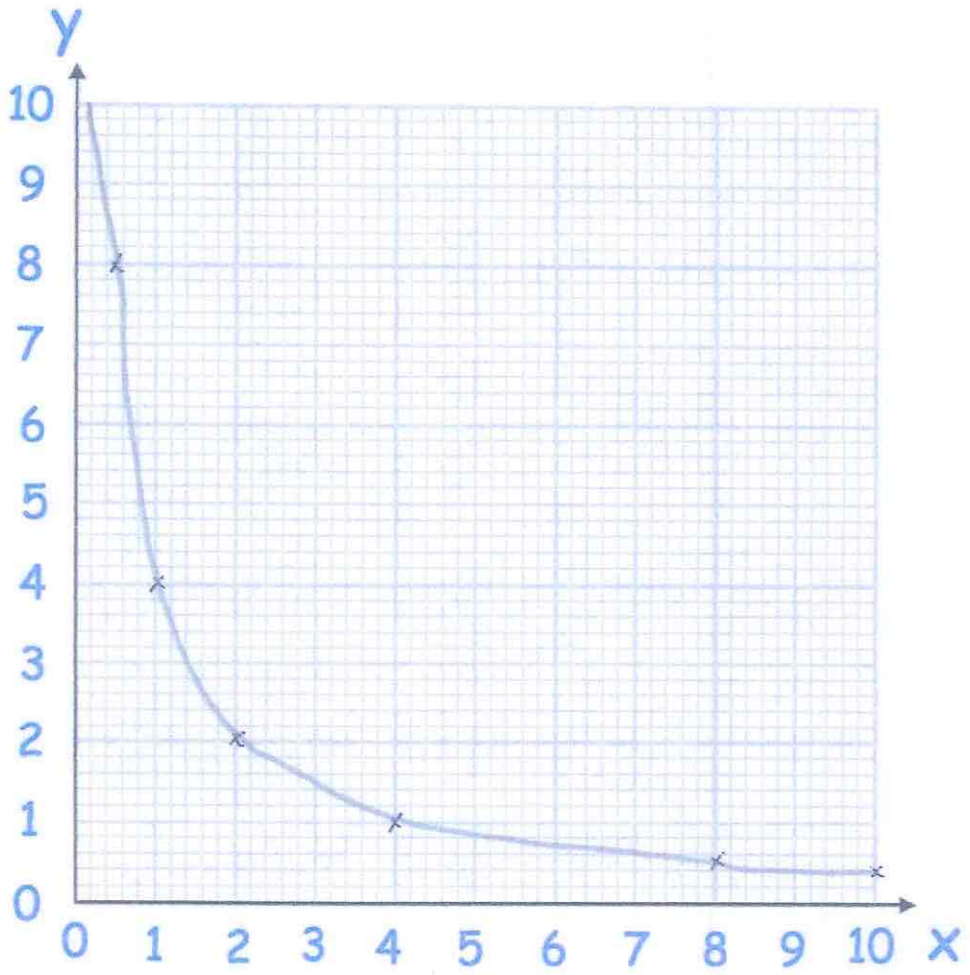
65

(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

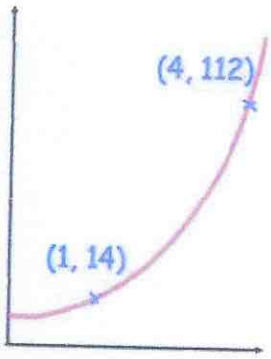
(2)

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



(2)

66.



$y = ab^x$

$(1, 14)$

$14 = ab^1$

$14 = ab$ (1)

The sketch shows a curve with equation
$y = ab^x$ where a and b are constants and $b > 0$

The curve passes through the points (1, 14) and (4, 112)

Calculate the value of a and b

$(4, 112)$ $\quad 112 = ab^4$ (2)

(2) ÷ (1) $\quad \frac{112}{14} = \frac{ab^4}{ab}$

$b^3 = 8$

$b = 2$

$14 = 2a$

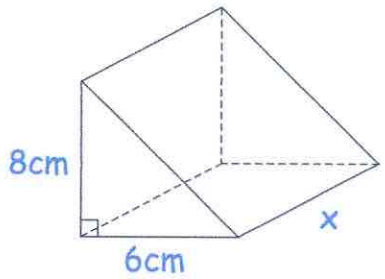
$a = 7$

a = 7

b = 2

(3)

67. The diagram shows a solid triangular prism.



The prism is made from wood and has a mass of 643.8g
The density of wood is 1.85g/cm³

Calculate the length of the prism.

$r = \frac{m}{d}$

$\frac{643.8}{1.85} = 348$

$24 \times x = 348$

$x = 14.5$

14.5

.....cm

(4)

---

68. Prove $(2n + 9)^2 - (2n + 5)^2$ is always a multiple of 4

$(2n+9)(2n+9) - (2n+5)(2n+5)$

$= 4n^2 + 36n + 81 - 4n^2 - 20n - 25$

$= 16n + 56$

$= 4(4n + 14)$

$\therefore$ multiple of 4

(4)

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

Give your answers to two decimal places.

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

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

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

x = 4.16 or x = -2.16

(3)

---

70. A curve has equation $y = x^2 - 6x - 17$

Work out the coordinates of the turning point by using completing the square.

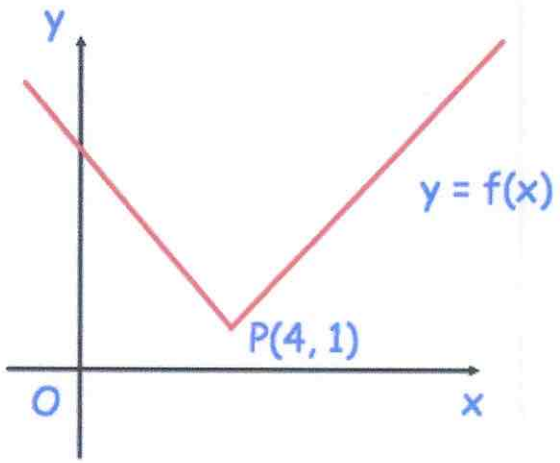
$$y = (x - 3)^2 - 9 - 17$$

$$y = (x - 3)^2 - 26$$

(3, -26)

(3)

71. Here is the graph of $y = f(x)$
The point P(4, 1) is a point on the graph.



What are the coordinates of the new position of P when the graph $y = f(x)$ is transformed to the graph of

(a) $y = -f(x)$

(4 , −1)

(1)

(b) $y = f(x) + 4$

(4 , 5)

(1)

72. 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.

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

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

or

$440 cm^2$

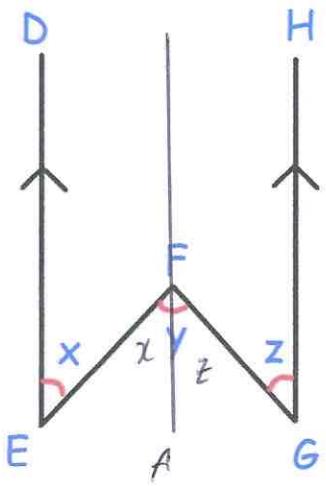
$440 cm^2$

.....

(3)

---

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



Prove that x + z = y

$\angle DEF = \angle EFA$ } Alternate angles are equal.

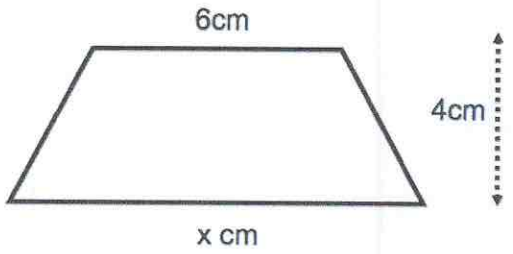
$\angle HGF = \angle GFA$ }

$\angle EFG = x + z$

$y = x + z$

(3)

74.



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)

---

75. 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)

76

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.

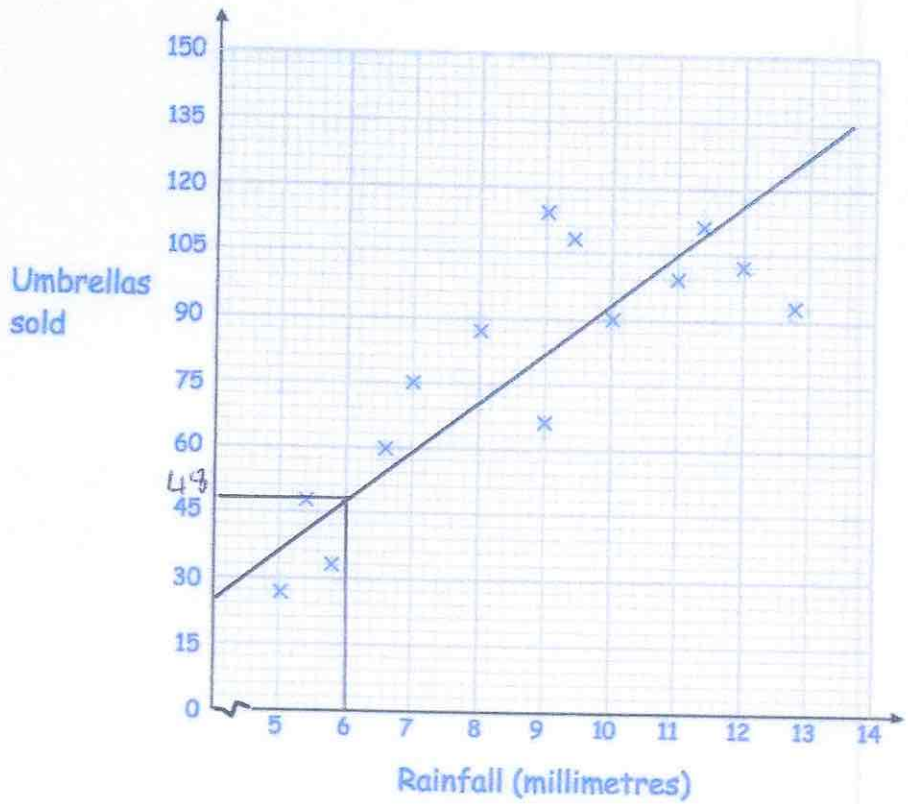
	Yr 12	Yr 13	total
French	25	15	40
Spanish	9	20	29
German	20	11	31
total	54	46	100

20

(4)

7 7 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

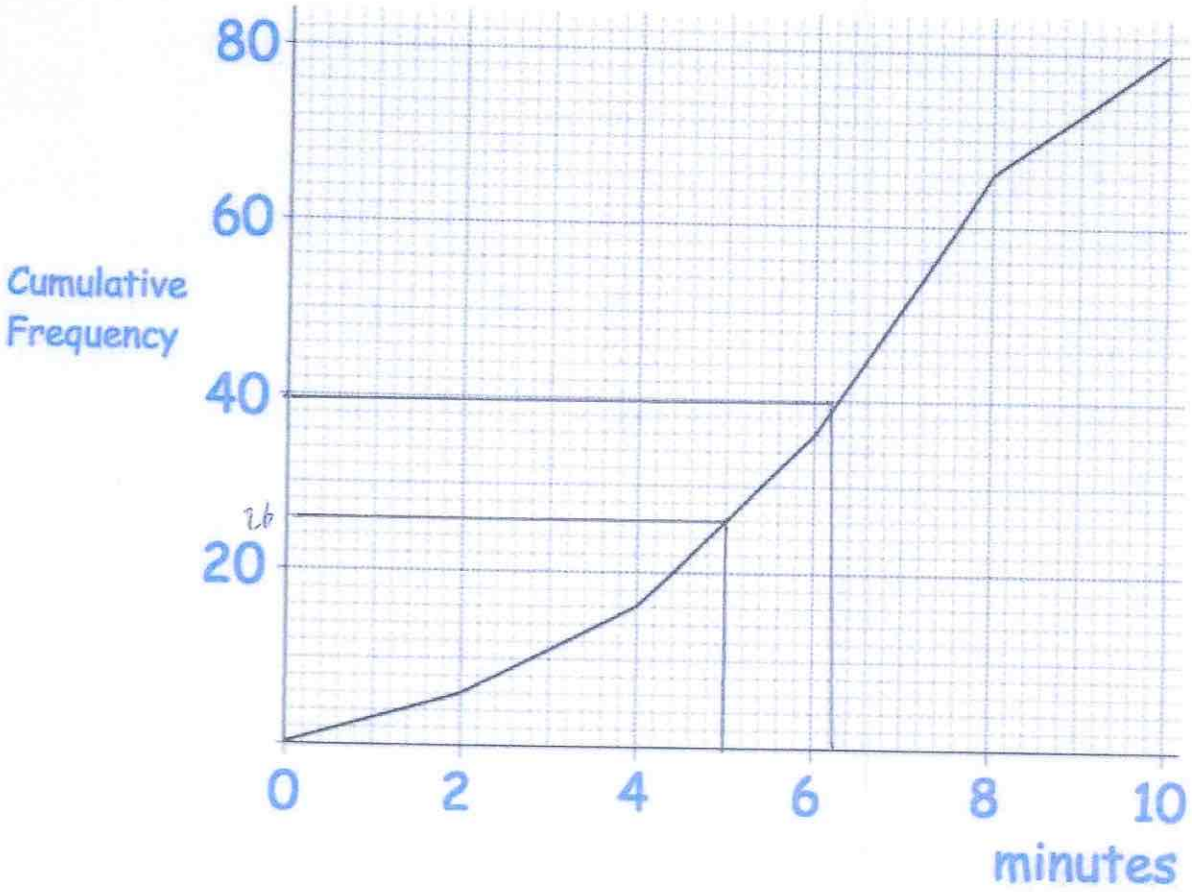
(2)

(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)

7 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)

79 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

$\frac{200}{2} = 100^{th}$

(or)

$\frac{201}{2} = 100.5^{th}$

Which class interval contains the median?

$20 < t \leq 30$

(1)

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

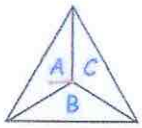
Number of pages, x	Frequency
$0 < x \leq 100$	7
$100 < x \leq 200$	25
$200 < x \leq 300$	40
$300 < x \leq 400$	12
$400 < x \leq 500$	16

Write down the modal class interval.

$200 < x \leq 300$

(1)

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

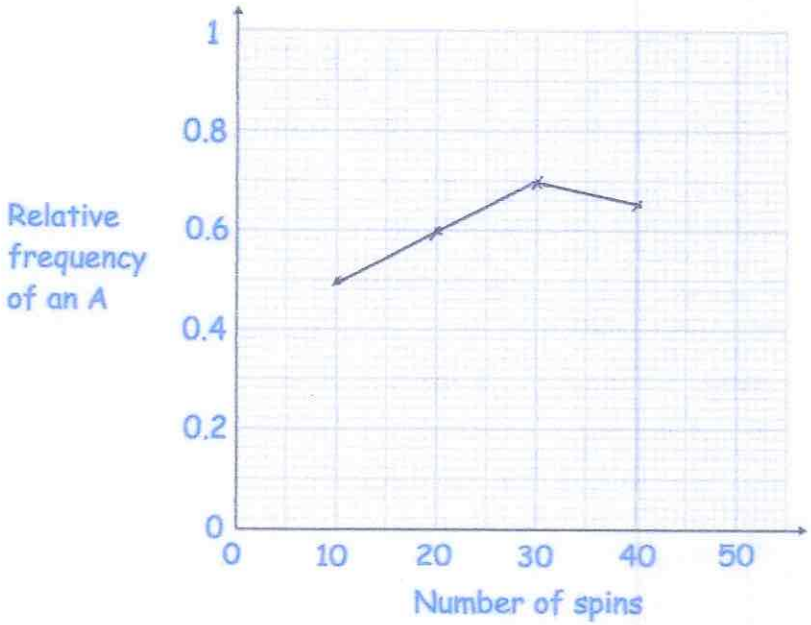


The spinner is spun and the frequency the letter A is recorded every 10 spins.
The table below shows this information.

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)

82. 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

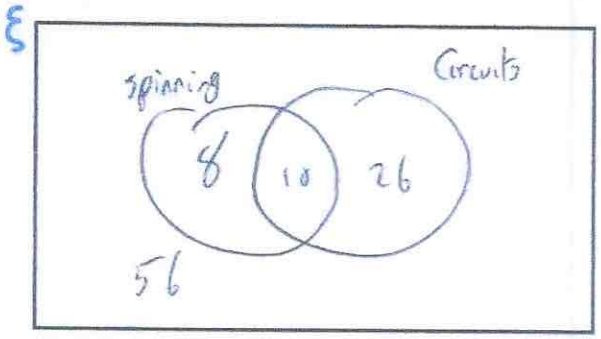
.....

(2)

83 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

$100 - 56 - 8 - 10$

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

.....

(2)

(c) attended exactly one class

$8 + 26$

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

.....

(2)

(d) attended spinning, given that they attended circuits

$\frac{10}{36}$

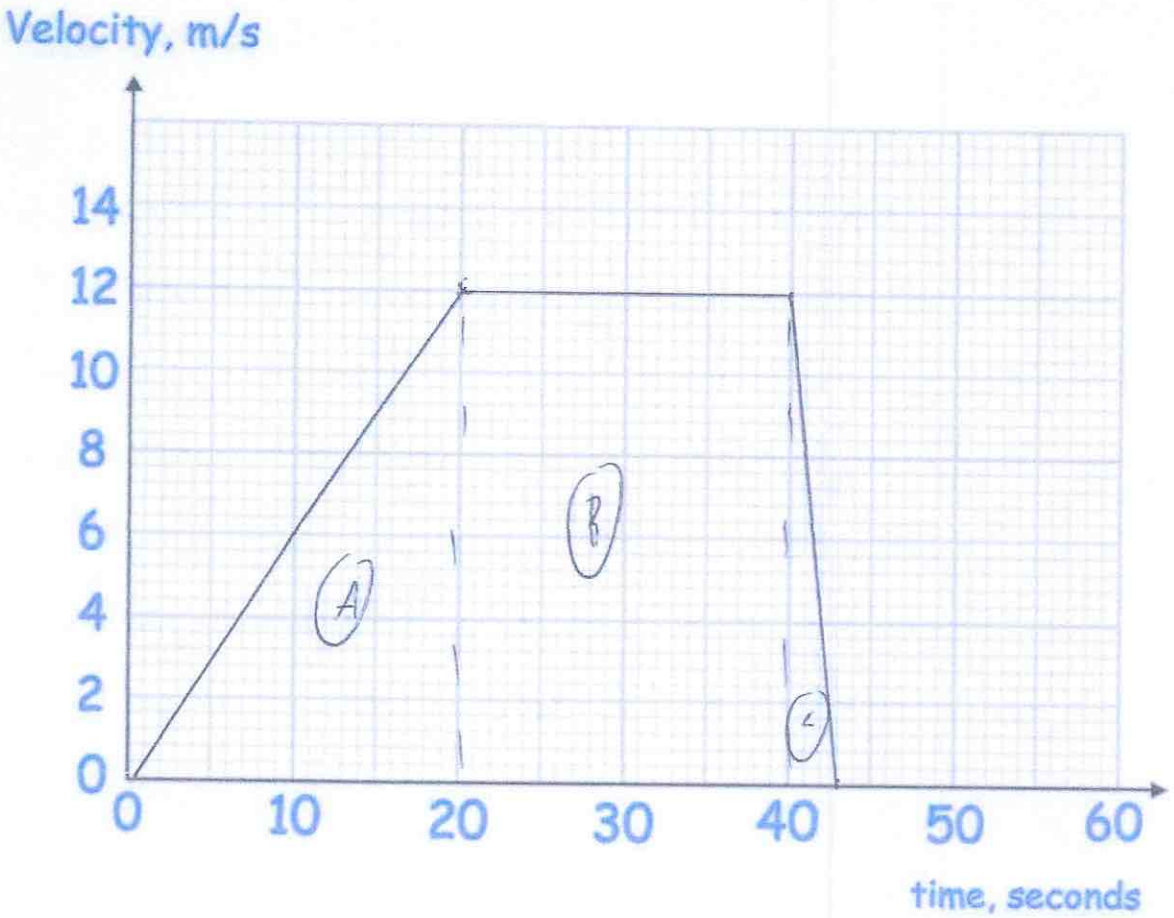
$\frac{10}{36}$ or $\frac{5}{18}$

.....

(2)

84 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)

85. $9x^3 + (x + a)(x + b) + cx \equiv ax^3 + x^3 + x^2 + 12x - 24$

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

$9 = a + 1$

$a = 8$

x

$b + a + c = 12$

$b + c = 4$

$-3 + c = 4$

$c = 7$

Constants

$ab = -24$

$b = -3$

a = 8

b = -3

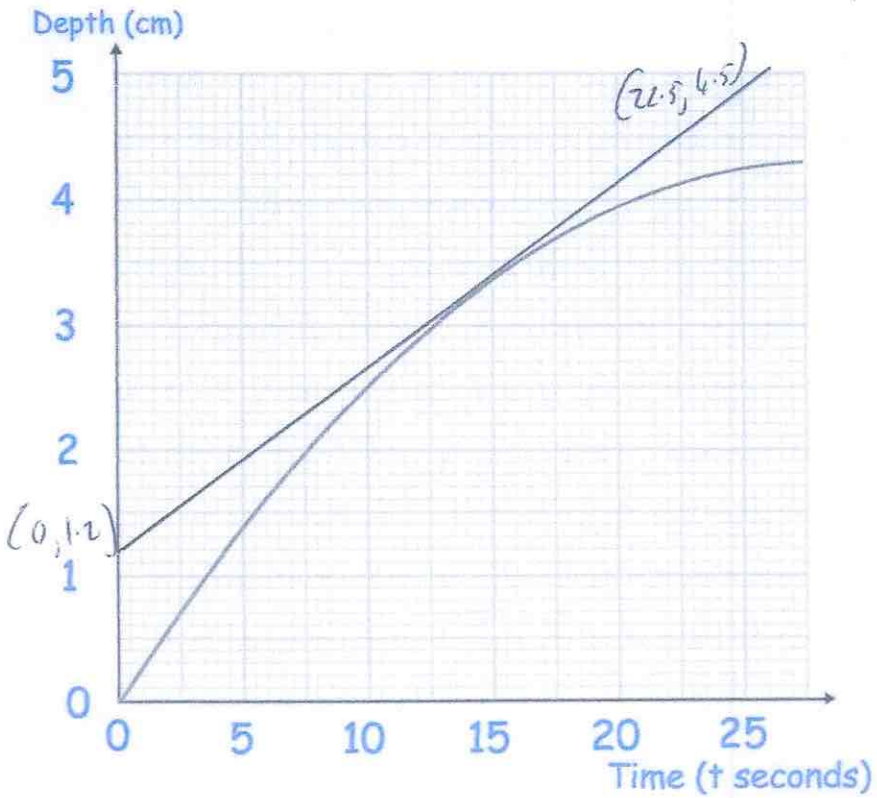
c = 7

(3)

86

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)

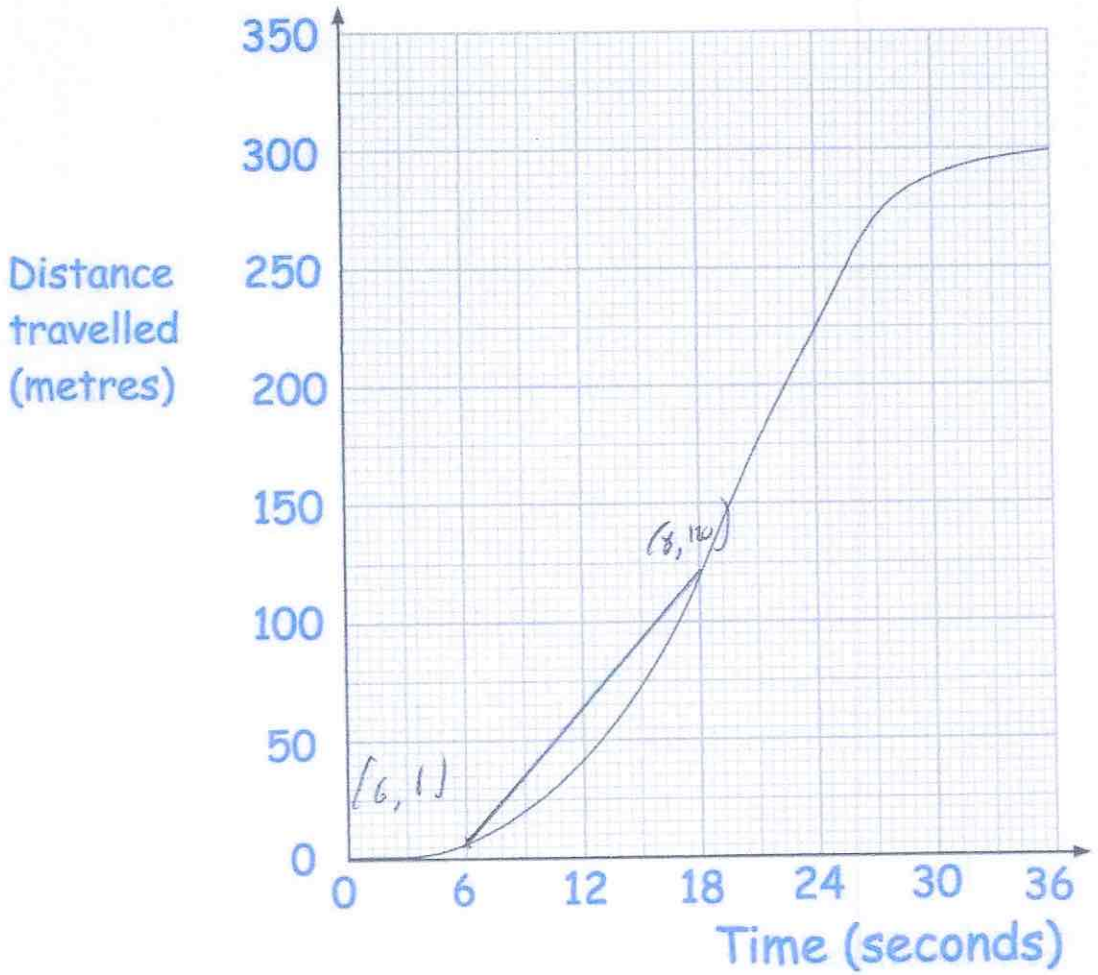
(c) Explain why your answer to (a) is only an estimate

It is only a hand drawn tangent

(1)

87

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.

$\frac{120}{12} = 9.5$

9.5

.....m/s

(3)

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

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

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

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

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 $x^3 + 2x = 1$

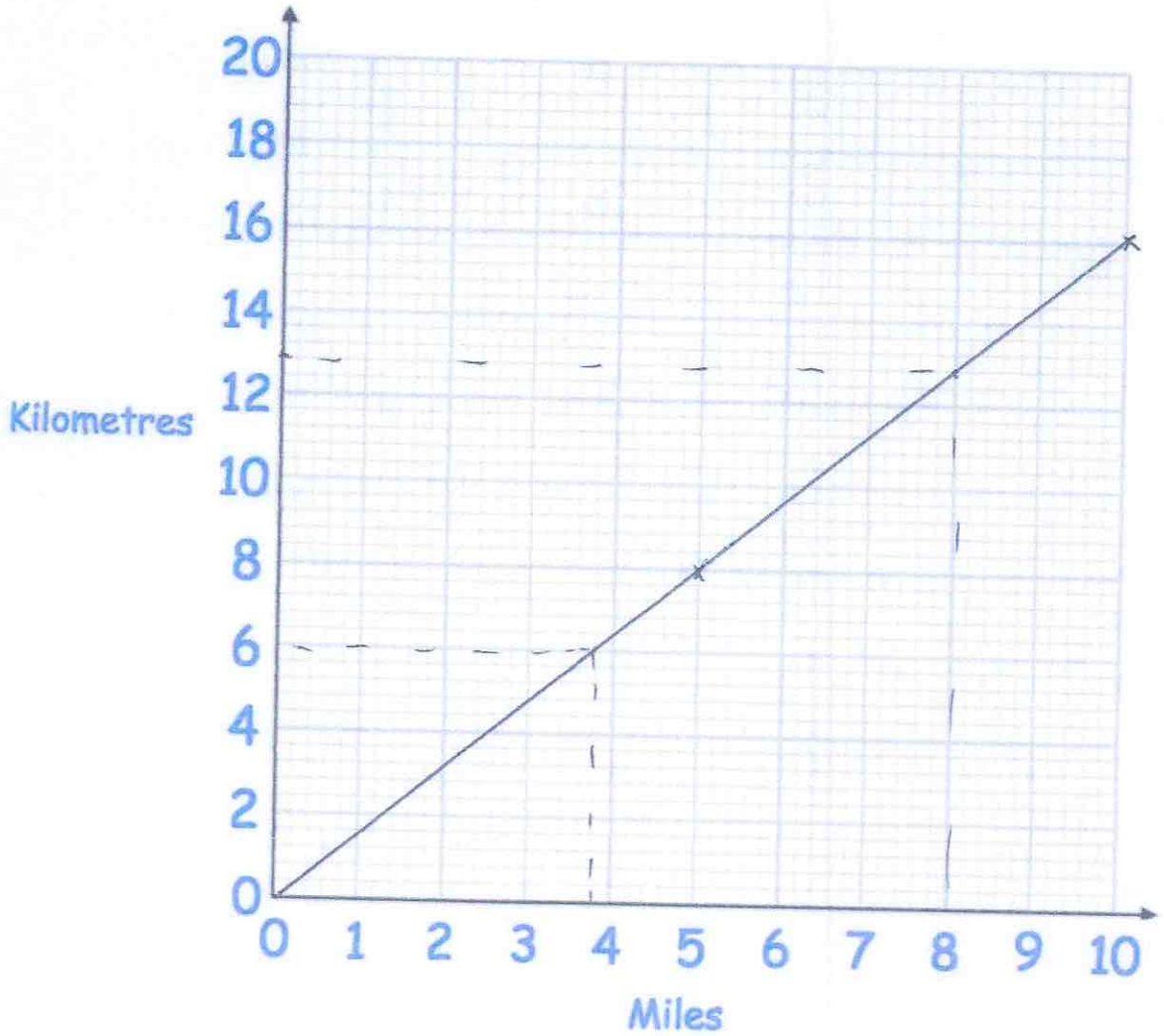
$x_1 = \frac{1}{2} - \frac{0^3}{2} = 0.5$

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

(3)

89

(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)

90. Simplify $9h + 5k + 4h - 8k$

$13h - 3k$

.....

(2)

---

91. x is an integer.

Write down all the solutions of the inequality $30 < 7x + 1 < 135$

$29 < 7x < 134$

$4.14... < x < 19.14..$

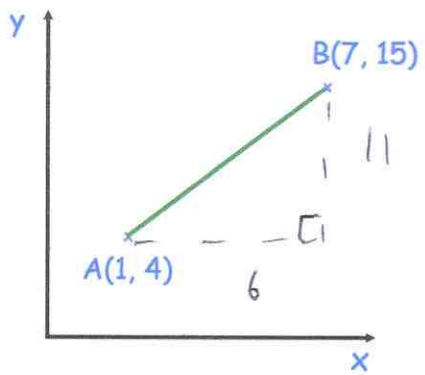
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

.....

(3)

---

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



Calculate the length of the line joining A and B.

$6^2 + 11^2 = 157$

$\sqrt{157} = 12.529...$

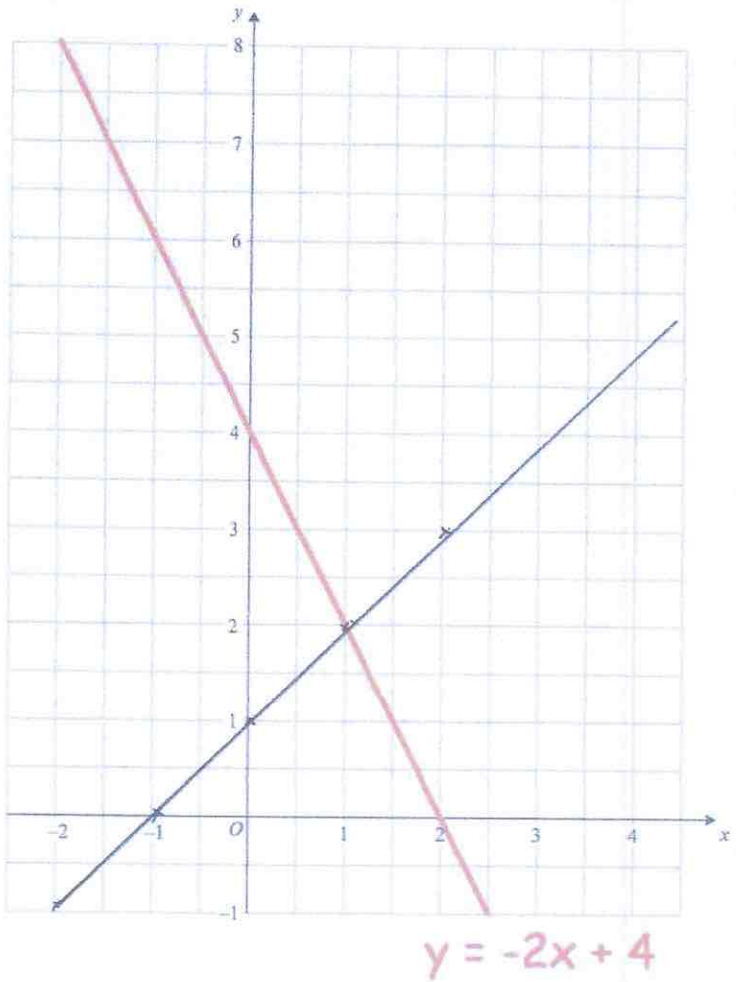
12.53 to 2dp

.....

(2)

93

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

$$y = -2x + 4$$

$$y = x + 1$$

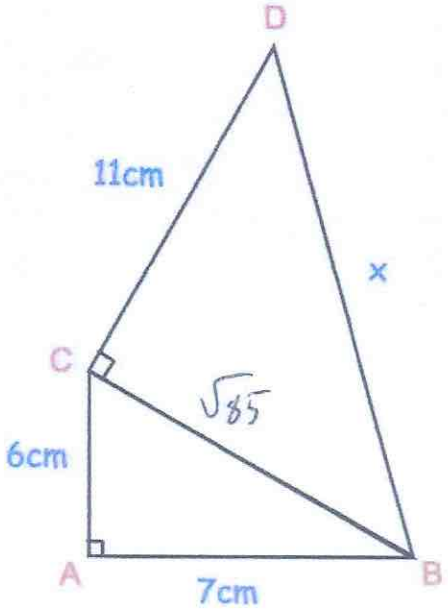
x = 1 , y = 2

(2)

92

94

Below are two triangles, ABC and BCD.



Find x

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

$BC^2 = 85$

$BC = \sqrt{85}$

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

$BD^2 = 206$

$BD = \sqrt{206}$

14.35 .....cm

(4)

95

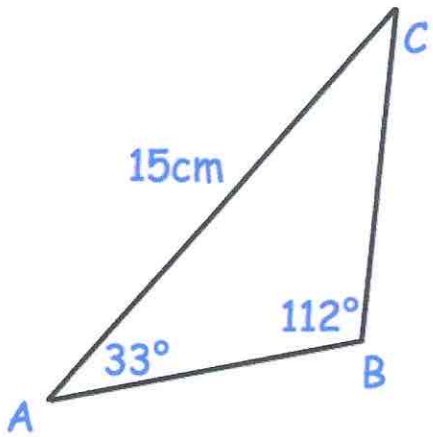
Convert 552 cm² into m²

$552 \div 100^2$

0.0552 ..... m²

(1)

96.



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

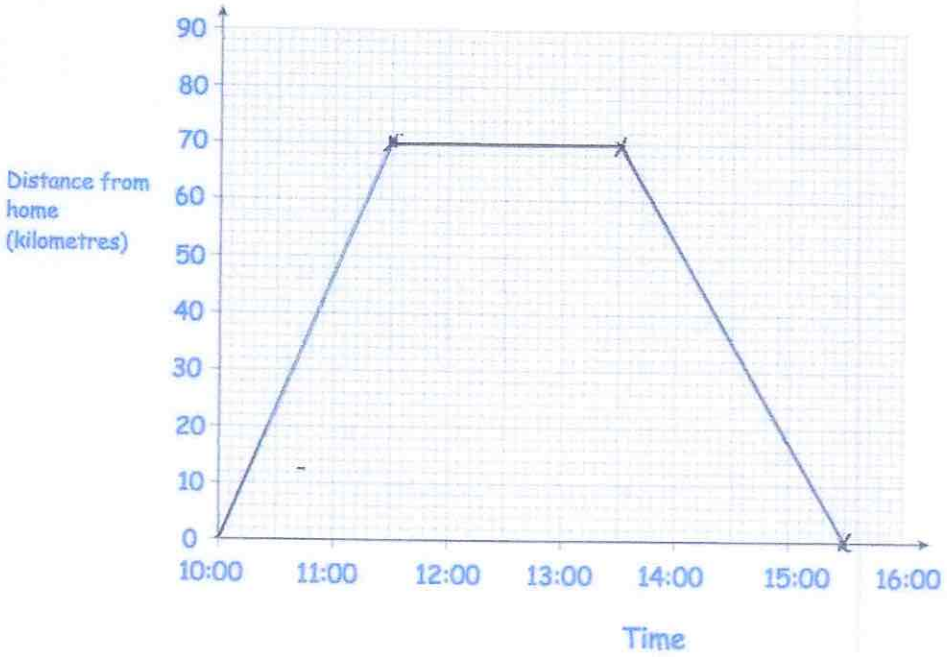
.....cm
(3)

to 2dp

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

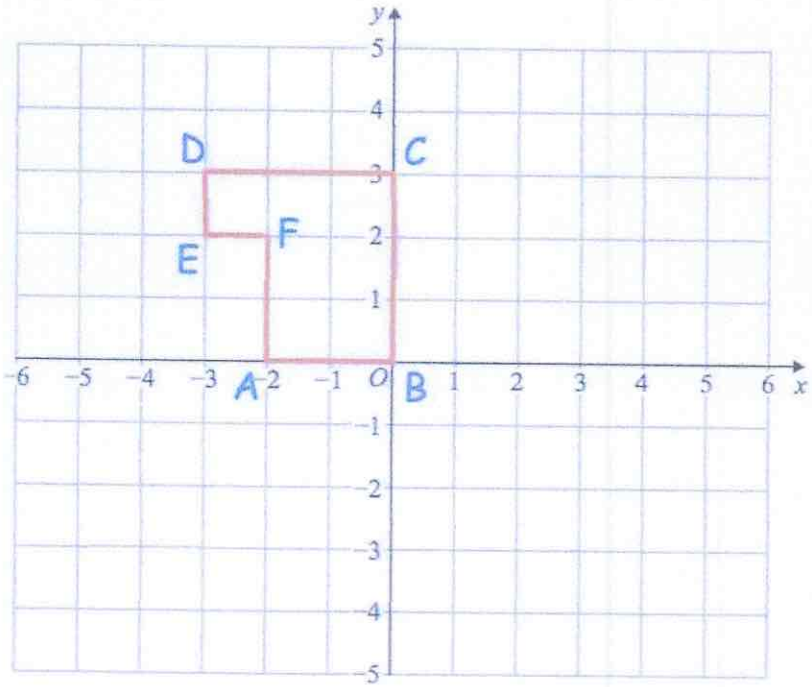
Bethany left home at 10:00 and arrived at the restaurant at 11:30.
She stayed at the family meal for 2 hours.
Bethany then drove home at a speed of 35 kilometres per hour.

Show this information on the distance-time graph.



(3)

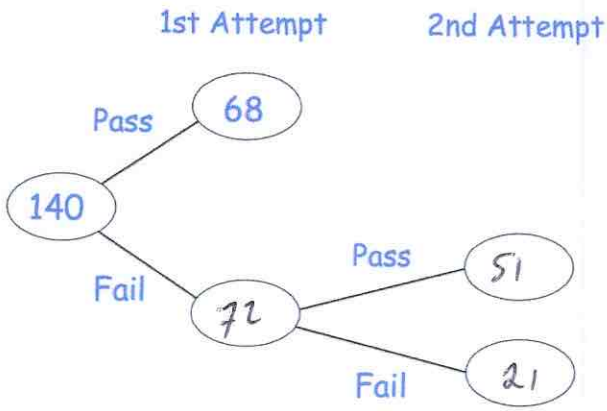
98 Here is shape ABCDEF



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

Rotation of 180° about centre (-2, 2)

99. 140 students sign up for a college course.
At the end of the course, each student has two attempts to pass a test.
If a student passes either attempt, they are awarded a certificate



85% of the students receive a certificate.

Work out how many students passed the test in their 2nd attempt.

85% of 140 = 119

119 − 68 = 51

(3)

---

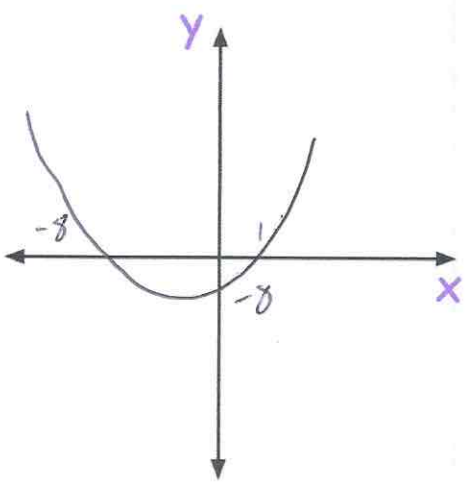
100. Sketch the graph of $y = x^2 + 7x - 8$

$y = 0^2 + 0 - 8$

$y = -8$

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

$x = -8$ or $x = 1$

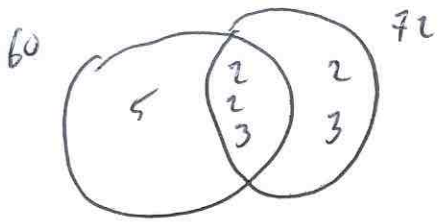


(3)

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

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

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



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

360

.....

(2)

102. 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?

$651 \div 1.55 = 420$

$161.20 \div 1.24 = \frac{130}{550}$

$\frac{22}{550} \times 100 = 4$

4

.....%

(4)

103. Solve

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

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

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

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

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

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

$x = -2$

.....

(5)

---

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

Write down the nth term of the sequence.

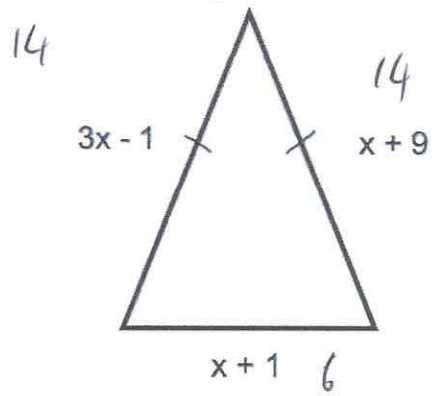
$7n + 3$

.....

(2)

---

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



Find the perimeter of the triangle

$3x - 1 = x + 9$

$2x = 10$

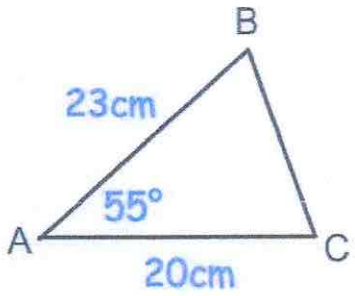
$x = 5$

34cm

.....

(4)

106



Calculate the length of BC.

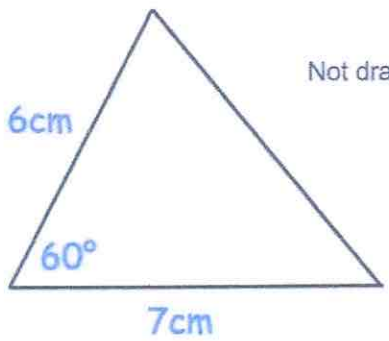
$x^2 = 23^2 + 20^2 - 2(20)(23)\cos 55$

$x^2 = 401.3\ldots$

20.03 .....cm

(3)

107



Not drawn is scale.

Calculate the area of the triangle.

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

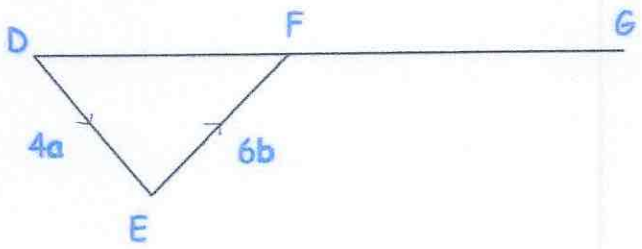
18.19 .....cm²

(2)

108

DFG is a straight line.

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



(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.

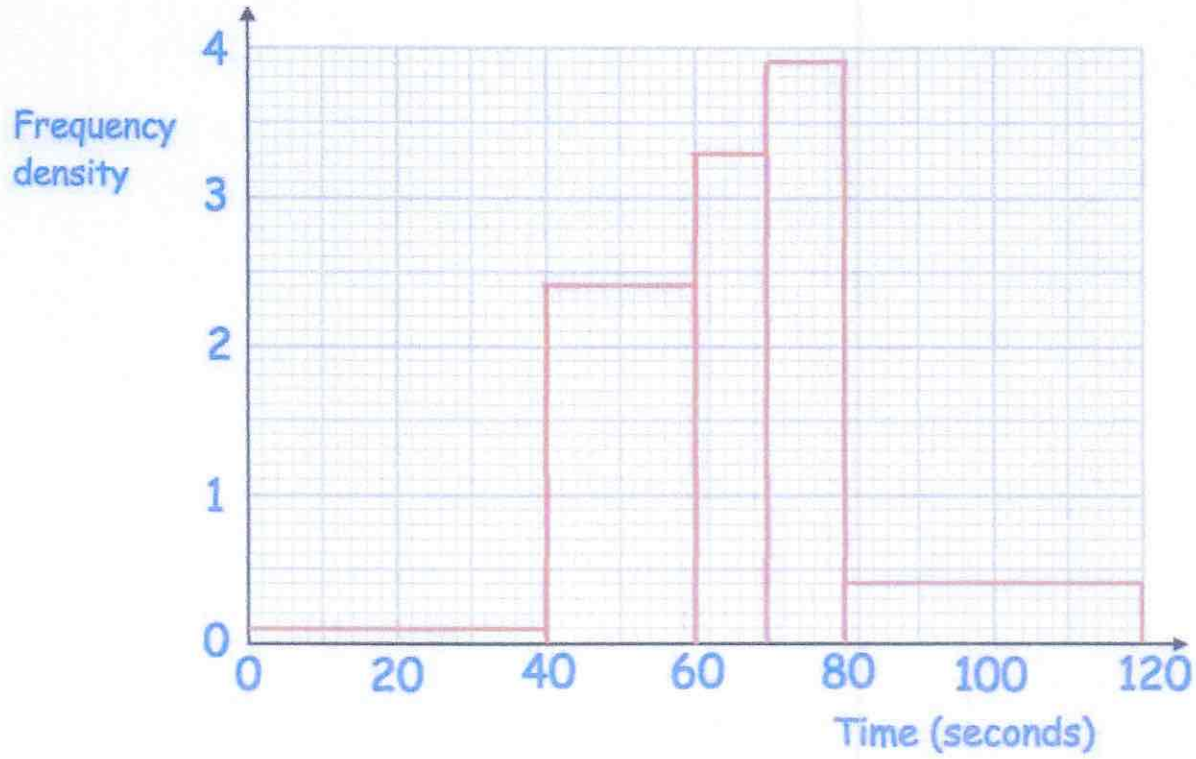
$(4\underline{a} + 6\underline{b}) \div 2 = 2\underline{a} + 3\underline{b}$

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

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

(2)

109 52 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)

110. 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.

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

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

$P(\text{not same}) = 1 - \frac{1}{28}$

$= \frac{27}{28}$

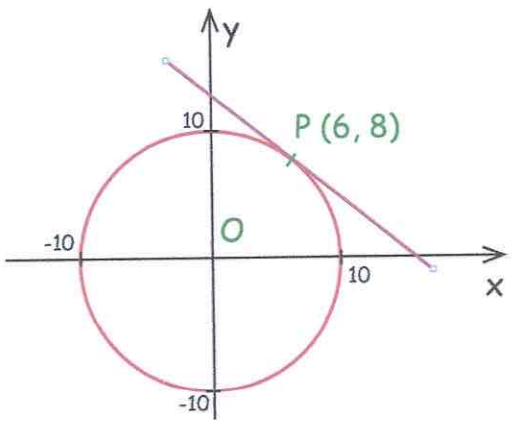
$\frac{27}{28}$

.....

(4)

---

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

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

$8 = -4.5 + c$

$c = 12.5$

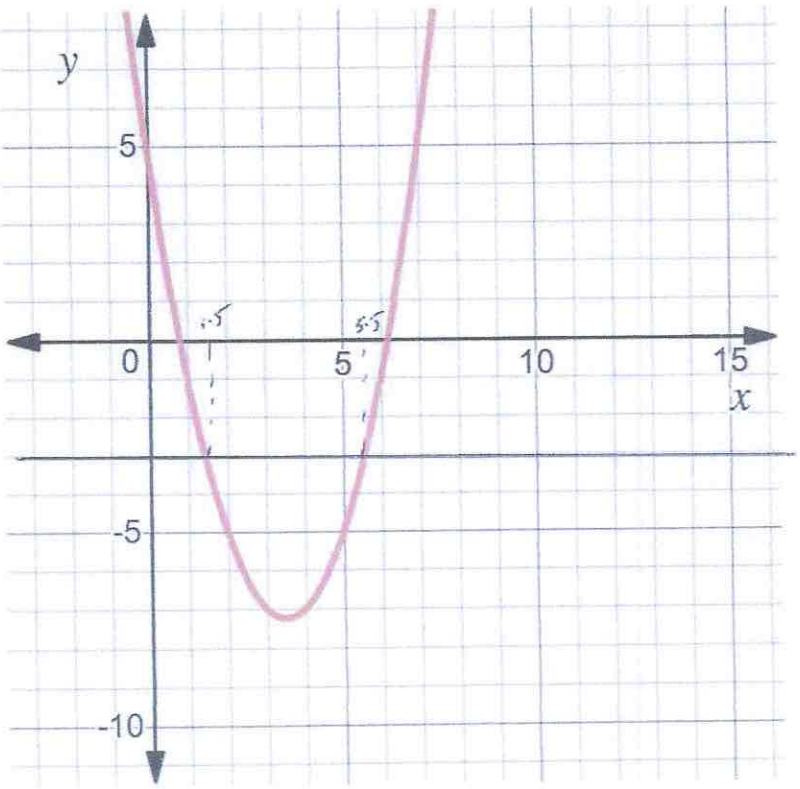
$y = -0.75x + 12.5$

.....

(4)

1/2

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

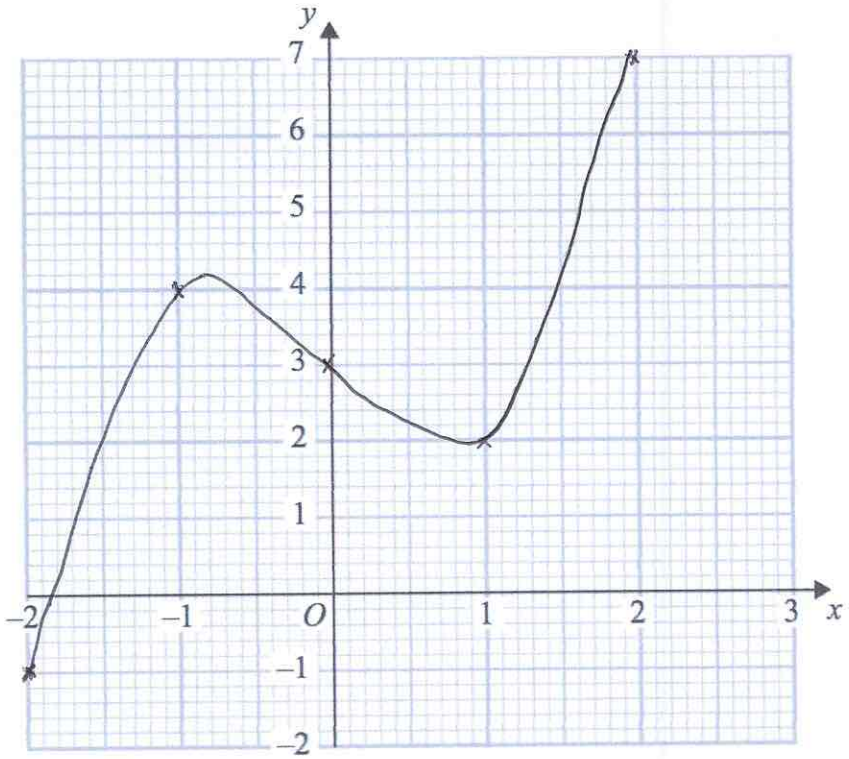


Use the graph to find estimates of the solutions of the equation
$x^2 - 7x + 5 = -3$

x = 1·5 and x = 5·5

(2)

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



(2)

114. 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.

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

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

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

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

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

$x = -30$ or $x = 9$

× ✓

9

.....

(3)

115 Simplify

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

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

$a^{4/15}$

.....

(2)

---

116. Solve the simultaneous equations

$2x + 4y = 26$
$3x - y = 4$

Do not use trial and improvement

$2x + 4y = 26$
$12x - 4y = 16$

$14x = 42$
$x = 3$

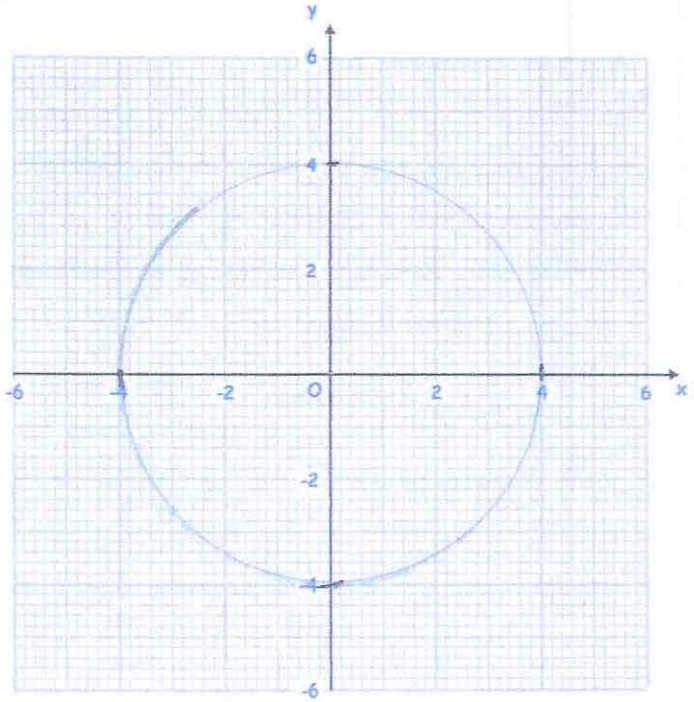
$9 - y = 4$
$y = 5$

x = 3 y = 5

(3)

117

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



$r = 4$

(2)