1(a). A bag only contains green, red, blue and yellow discs.

Mei carries out an experiment.
She picks one disc at a time from the bag, records its colour and then returns the disc to the bag.
When she has finished the experiment, Mei works out the relative frequency of each colour.
Some of her results are shown in the table.

Colour	Green	Red
Relative frequency	0.25	0.15

The relative frequency of the yellow discs was five times the relative frequency of the blue discs.

In total, there are 3000 discs in the bag.

Use this information to find an estimate for the **total** number of green and yellow discs that are in the bag.
You must show your working.

..... **[5]**

(b). Explain why your estimate may **not** be reliable.

---**[1]**

2(a). The expected value of a painting, £P, is given by the formula

$P = 3000 \times 1.15^n$

where n is the number of years after it was bought and $0 \leqslant n \leqslant 4$.

Write down the value of the painting when it was bought.

£ ..... **[1]**

(b). Write down the annual percentage increase in the expected value of the painting.

..... %**[1]**

(c). An art collector correctly works out 3000×1.15^{10} as 12 137.

They say,

The expected value of the painting 10 years after it was bought is £12 137

What assumption has the art collector made?

---**[1]**

3. y is inversely proportional to x^2.

Find the percentage decrease in y when x is increased by 20%.

..... % **[4]**

4. y is directly proportional to the cube of t.
$y = 14$ when $t = 2$.

t is directly proportional to x.
$t = 16$ when $x = 4$.

Find a formula for y in terms of x.
Give your answer in its simplest form.
You must show your working.

$y =$ ..... **[6]**

5. A person invests £12 000 at a rate of 15% per year compound interest.

Calculate the total amount of **interest** earned after 3 years.

£ ..... **[3]**

6. There is a total of 328 balls in a bag.
There are white balls, red balls and green balls only.

The ratio of white balls to red balls is 2 : 3.
The ratio of red balls to green balls is 7 : 2.

Work out the number of white balls in the bag.

..... **[4]**

7. A cylinder has a radius of 11.2 cm.
The ratio of the radius of the cylinder to the height of the cylinder is 4 : 9.

Find the volume of the cylinder.

..... cm^3 **[4]**

8. Here is a question and an incorrect solution.

Question:
You are given
$y \propto x$ and $y = 9$ when $x = 2$.

Find a formula linking x and y.

Solution:
$y \propto x$ so $y = x - c$
Substituting $y = 9$ and $x = 2$ gives
$9 = 2 - c$
$c = -7$
So, $y = x - 7$

Describe the error made and write out a correct solution.

The error is

A correct solution is

---

[3]

9. A regular polygon has n sides.
The interior angle of the polygon is 7 times its exterior angle.

Find the value of n.

n = ... **[4]**

10. Sasha and Taylor each have a stamp collection.

They organise their stamp collections according to where the stamps come from: United Kingdom (UK), European Union (EU), Other.

The table shows the number of stamps in each collection and the ratio UK : EU : Other.

	Number of stamps	**Ratio UK : EU : Other**
Sasha's collection	1210	7 : 2 : 2
Taylor's collection	531	6 : 1 : 2

When they put the two stamp collections together, Sasha and Taylor claim that at least $\frac{2}{3}$ of all the stamps come from the UK.

Are they correct?
Show how you decide.

They are ---------- because ----------

---

[5]

11(a).

Ryan invests £10 000 at a rate of 3% per year compound interest.
Ryan says

After one year, my investment will get £300 in interest and will be worth £10 300. Therefore, after two years, my investment will get another £300 in interest and will be worth £10 600.

Is Ryan correct?
Give a reason for your answer.

---------- because ----------

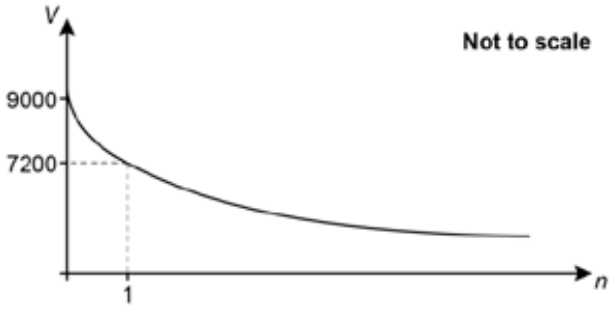
---

[1]

(b). Ryan buys a van.
The value, £V, of the van after n years is given by the formula

$V = a \times b^n$.

The graph shows some information about the value of the van.



Find the value of a and the value of b.

a = ...
b = ... **[4]**

12. A bottle contains $1\frac{2}{3}$ litres of cordial.

To make lemon squash, 1 part of this cordial is mixed with 8 parts of water.

Cups that can hold $\frac{1}{4}$ of a litre are completely filled with this lemon squash.

Work out the maximum number of cups that can be filled from the bottle of cordial.
You must show your working.

..... **[6]**

13(a). *b* is directly proportional to *a*.

Write down the percentage increase in *b* when *a* is increased by 200%.

.....% **[1]**

(b). *c* is inversely proportional to *a*.

Write down the percentage increase in *c* when *a* is decreased by 50%.

.....% **[1]**

14(a). Two bags of fruit contain only apples and bananas.
In bag X, the ratio of apples to bananas is 3 : 7.
In bag Y, $\frac{3}{10}$ of the fruit are apples.

Jack says

Bag X and bag Y contain the same number of apples.

Tick the correct statement.

- ☐ Jack is definitely correct
- ☐ Jack might be correct, or might not be correct
- ☐ Jack is definitely not correct

Show how you decided.

--- **[3]**

(b). Jack adds 4 bananas to bag X.
The ratio of apples to bananas is now 2 : 5.

How many apples are in bag X?

..... **[3]**

15. y is inversely proportional to x^4.
$y = 4$ when $x = 6$.

Find a formula linking x and y.

..... **[3]**

16. y is inversely proportional to x^2.

Find the percentage decrease in y when x is increased by 25%.

..... % **[4]**

17(a). A bag only contains green, red, blue and yellow discs Orla carries out an experiment.
She picks one disc at a time from the bag, records its colour and then returns the disc to the bag.
When she has finished the experiment, Orla works out the relative frequency of each colour.
Some of her results are shown in the table.

Colour	Green	Red
Relative frequency	0.35	0.25

The relative frequency of the yellow discs was three times the relative frequency of the blue discs.

In total, there are 2000 discs in the bag.

Use this information to find an estimate for the **total** number of green and yellow discs that are in the bag.
You must show your working.

..... **[5]**

(b). Explain why your estimate may **not** be reliable.

---**[1]**

18(a). The expected value of a painting, £P, is given by the formula

$P = 2500 \times 1.2^{n}$

where n is the number of years after it was bought and $0 \leq n \leq 4$.

Write down the value of the painting when it was bought.

£ ..... **[1]**

(b). Write down the annual percentage increase in the expected value of the painting.

..... % **[1]**

(c). An art collector correctly works out 2500×1.2^{10} as 15479.

They say,

The expected value of the painting 10 years after it was bought is £15479.

What assumption has the art collector made.

---**[1]**

19. There is a total of 354 balls in a bag.
There are white balls, red balls and green balls only.

The ratio of white balls to red balls is 3 : 4.
The ratio of red balls to green balls is 5 : 6.

Work out the number of green balls in the bag.

..... **[4]**

20. A cylinder has a radius of 8.4 cm.
The ratio of the radius of the cylinder to the height of the cylinder is 2 : 5.
Find the volume of the cylinder.

..... cm^3 **[4]**

21. y is directly proportional to the square of t.
$y = 14$ when $t = 2$.

t is directly proportional to x.
$t = 12$ when $x = 3$.

Find a formula for y in terms of x.
Give your answer in its simplest form.
You must show your working.

$y =$ ..... **[6]**

22. A person invests £8000 at a rate of 5% per year compound interest.

Calculate the total amount of **interest** earned after 3 years.

£ ..... **[3]**

23(a). x and y are related by the equation $\frac{y}{x} = 36$.

Tick the correct statement.

- ☐ y is directly proportional to x
- ☐ y is inversely proportional to x
- ☐ y is not proportional to x

[1]

(b). y is inversely proportional to x^3.
$y = 3.5$ when $x = 2$.

Find a formula linking x and y.

..... **[3]**

24. Charlie invests £2500 for 2 years in a bank account paying r% per year compound interest.
At the end of 2 years, the amount in the bank account is £2809.

Calculate r.

$r =$ ..... **[4]**

25. A large box of chocolates contains dark, milk and white chocolates.
When Casey opens the box, the ratio of dark to milk to white chocolates is 4 : 3 : 2.
Casey's family eat 5 of the dark chocolates, none of the milk chocolates and all of the white chocolates.
The ratio of dark to milk chocolates is now 9 : 8.

How many **white** chocolates did Casey's family eat?

..... white chocolates **[4]**

26. A biologist assumes the population, P, of birds on an island can be predicted using the formula

$P = 2300 \times 1.034^n$

where n is the number of years after the start of 2020.

i. Show that the number of birds is predicted to exceed 4000 during 2036.

[3]

ii. A researcher says that between 2022 and 2032 the percentage increase per year in the population will be 2.1%.

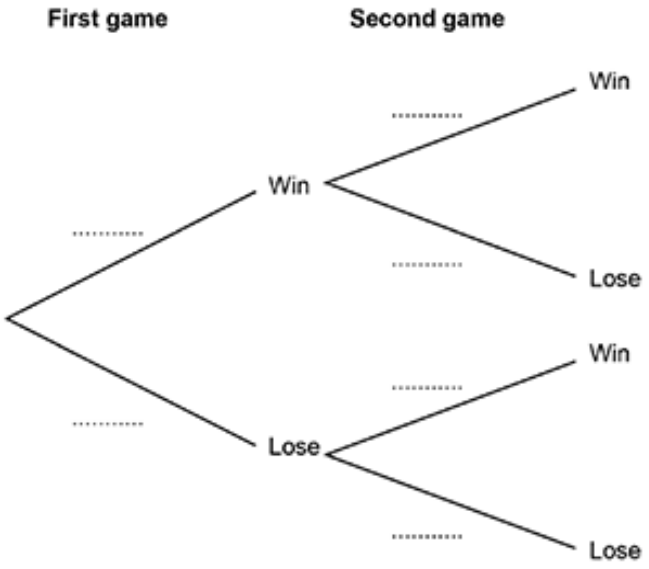
If the researcher is correct, explain how this new information will affect the answer in part **(i)**.

[1]

27(a). In a computer game the player can either win or lose.
A student thinks the ratio of the probability of winning to the probability of losing is 3 : 7.

The student plays two games.

Use the information to complete the tree diagram.



[3]

(b). Find the probability that the student loses at least one of the two games.

..... **[3]**

(c). The student now thinks the ratio of the probability of winning to the probability of losing has changed to 3 : 5.

Explain the effect this change will have on your answer to part **(b)**.

---

[1]

28(a). A biologist assumes the population, P, of birds on an island can be predicted using the formula

$P = 2300 \times 1.034^n$

where n is the number of years after the start of 2020.

Write down the percentage increase per year that is used in the formula.

..... % **[1]**

(b). Calculate the predicted population at the start of 2025.

..... **[2]**

29. y is directly proportional to the square of x.

Complete the table.

x	1	3	
y	5		180

[4]

30. y is inversely proportional to x^3.
$y = 4$ when $x = 12$.

Find a formula linking x and y.

..... **[3]**

31(a). Two bags of fruit contain only apples and bananas.
In bag X, the ratio of apples to bananas is 5 : 7.

In bag Y, $\frac{5}{12}$ of the fruit are apples.

Finley says

Bag X and bag Y contain the same number of apples.

Tick the correct statement.

- ☐ Finley is definitely correct
- ☐ Finley might be correct, or might not be correct
- ☐ Finley is definitely not correct

Show how you decided.

---

[3]

(b). Finley adds 4 apples to bag X.
The ratio of apples to bananas is now 11 : 14.

How many bananas are in bag X?

..... **[3]**

32(a). *y* is directly proportional to *x*.

Write down the percentage increase in *y* when *x* is increased by 100%.

..... % **[1]**

(b). z is inversely proportional to x.

Write down the percentage decrease in z when x is increased by 100%.

..... % **[1]**

33(a). Sasha invests £1000 at a rate of 5% per year compound interest.
Sasha says

After one year, my investment will get £50 in interest and will be worth £1050.
Therefore, after two years, my investment will get another £50 in interest and will be worth £1100.

Is Sasha correct?
Give a reason for your answer.

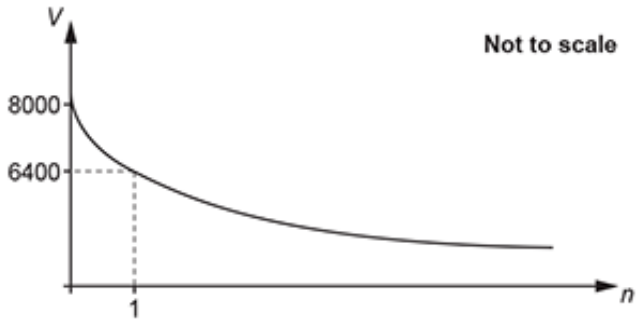
_____ because _____

_____ **[1]**

(b). Sasha buys a car.
The value, £V, of the car after n years is given by the formula

$V = a \times b^n$.

The graph shows some information about the value of the car.



Find the value of a and the value of b.

a = ...

b = ... **[4]**

34. A bottle contains $1\frac{3}{4}$ litres of cordial.
To make orange squash, 1 part of this cordial is mixed with 7 parts of water.

Cups that can hold $\frac{1}{6}$ of a litre are completely filled with this orange squash.

Work out the maximum number of cups that can be filled from the bottle of cordial.
You must show your working.

..... **[6]**

35. A regular polygon has *n* sides.
The interior angle of the polygon is 15 times its exterior angle.

Find the value of *n*.

n = ... **[4]**

36. Sasha and Taylor each have a stamp collection.

They organise their stamp collections according to where the stamps come from:
United Kingdom (UK), European Union (EU), Other.

The table shows the number of stamps in each collection and the ratio UK : EU : Other.

	Number of stamps	**Ratio UK : EU : Other**
Sasha's collection	1638	9 : 3 : 2
Taylor's collection	660	8 : 1 : 2

When they put the two stamp collections together, Sasha and Taylor claim that at least $\frac{2}{3}$ of all the stamps come from the UK.

Are they correct?
Show how you decide.

They are _____ because _____

_____

_____ **[5]**

37. Here is a question and an incorrect solution.

Question:
You are given
$y \propto x$ and $y = 9$ when $x = 2$.

Find a formula linking x and y.

Solution:
$y \propto x$ so $y = x + c$
Substituting $y = 9$ and $x = 2$ gives
$9 = 2 + c$
$c = 7$
So, $y = x + 7$

Describe the error made and write out a correct solution.

The error is _____

_____

A correct solution is _____

_____

_____

_____

_____

[3]

38(a). The time taken to paint a wall is inversely proportional to the number of people painting.
It takes 50 minutes for 3 people to paint the wall if nobody stops painting.

Nina, Ling and Charlie start painting the wall.
After 20 minutes Nina stops painting.
She leaves Ling and Charlie to finish painting the wall.

Assume that Nina, Ling and Charlie paint at the same rate.

Work out the **total** time taken to paint the wall.

…….…….……. minutes **[3]**

(b). y is inversely proportional to x^2.
$y = 4$ when $x = 1.5$.

Find the value of y when $x = 6$.

…….…….……. **[3]**

39. The number of ants, P, in a colony is given by the formula
$P = b^x a$

where x is the number of months after the start of June.

At the start of June, there were 15 000 ants in the colony.
After one month, there were 13 800 ants in the colony.

Find the value of a and the value of b.
Give the value of b as a decimal.

a = ...

b = ... **[4]**

40. y is directly proportional to $\sqrt{x}$.
$y = 1$ when $x = 9$.

Find a formula for y in terms of x.

..... **[3]**

41(a). An estimate for the number of seals on an island is given by the formula

$P = 4300 \times 1.03^t$.

where P is the number of seals t years after the start of year 2020.

Write down the annual percentage increase in the number of seals on the island.

…… **[1]**

(b). Use the formula to show that there may have been about 3600 seals on the island at the start of year 2014.

[2]

42(a). The price of a seat on a flight, £P, is given by

$P = 51 \times 1.008^n$

where n is the number of seats already sold on this flight.

Write down the percentage increase in price of the second seat sold compared to the first seat sold.

…… % **[1]**

(b). Show that the price of the 40th seat sold is less than £70.

[2]

43. It takes 45 minutes to fill a garden pond using water from 4 identical hose pipes.

Assuming the rate of flow of water from each hose pipe is the same, work out how many minutes it would take to fill the same garden pond using 3 of these hose pipes.

…… minutes **[2]**

44. On Dev's bookcase, the ratio of fiction to non-fiction books is 2 : 3.
Dev adds 2 non-fiction books to the bookcase.
The ratio of fiction to non-fiction books is then 5 : 8.

How many books are now on the bookcase in total?

…….. books **[4]**

45. y is inversely proportional to the square root of x.
$y = 5$ when $x = 256$.

Find the value of y when $x = 64$.

y = ... **[3]**

46(a). Charlie invests £3500 at a rate of 6.5% per year simple interest.

Find the value of the investment at the end of 6 years.

£…….. **[3]**

(b). At the end of t years, the value of the investment is over £9 500 for the first time.

Find the value of t.

t = ……..……..……..…… **[3]**

47. A zoo counts its animals.
The ratio of bears to wolves is 3 : 5.
The ratio of gorillas to wolves is 2 : 3.

There are 4 more gorillas than bears.

Work out the number of wolves in the zoo.

……..……..……..…… **[4]**

48. y is directly proportional to the square of x.

Find the percentage decrease in y when x is decreased by 40%.

…….…… % **[4]**

49. Kai has a full bottle of vitamins.
The bottle holds 25 doses of vitamins.

Each day Kai takes one dose of vitamins out of the bottle.
After 15 days, there are 150 millilitres of vitamins left in the bottle.

Work out how many millilitres of vitamins the bottle holds when full.

..... ml **[4]**

50. Ariel, Blake and Casey work in a cafe.
Customers give spare change as tips.
At the end of each week, Ariel, Blake and Casey share the total amount of tips between them in the ratio matching the number of hours they worked that week.

This week:

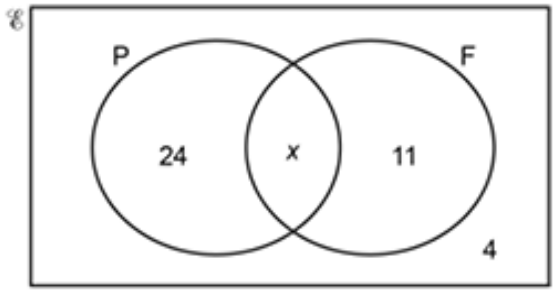
- Ariel's share of the tips was £25.50.
- Blake worked three times as many hours as Ariel.
- Casey worked 4 more hours than Ariel.
- The total hours worked by Ariel, Blake and Casey was 89 hours.

Calculate the total amount of tips received this week.
You must show your working.

£ ..... **[6]**

51(a). In a survey about snacks, some students were asked whether they like popcorn (P) and whether they like fruit (F).

The Venn diagram shows some of the results.
x students liked both types of snacks.



The ratio of the number of students who liked popcorn to the number who liked fruit was 3 : 2.

Work out the **total** number of students in the survey.

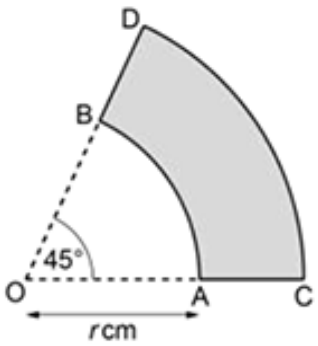
…….. **[4]**

(b). One of the students is selected at random.

Find the probability that this student does **not** like fruit given that they like popcorn.

…….. **[2]**

52. The diagram shows a shaded shape made by removing sector OAB from sector OCD.
Both sectors have an angle of 45°.
The radius, OA, of the smaller sector is *r* cm.
The ratio of radius OA to radius OC is 3 : 4.



Not to scale

Work out, in terms of π and *r*, the **total** length of arc AB and arc CD.
Give your answer in its simplest form.
You must show your working.

…….. cm **[5]**

53. Recipes measure small quantities in teaspoons and tablespoons.
3 teaspoons is equivalent to 1 tablespoon.

A curry recipe uses $\frac{2}{3}$ of a teaspoon of salt and 3 tablespoons of lemon juice.

The ratio of salt to lemon juice used in the recipe can be written in the form 1 : *n*.

Find the value of *n*.

n = …….. **[3]**

54. y is inversely proportional to x^2.
$y = 8$ when $x = 3$.

Find the value of y when $x = 12$.

$y =$ ……..…….…… **[3]**

55(a). Reece bought a house at the start of 2017.
Reece assumes the value of the house, £V, can be predicted using the formula

$V = 195\,000 \times 1.045^n$

where n is the number of years after the start of 2017.

Explain how you know that the value of the house is predicted to increase each year.

---------- **[1]**

(b). Write down the percentage increase per year that is used in the formula.

……..…….…… % **[1]**

(c). Write down the value of the house at the start of 2017.

£……..…….…… **[1]**

(d). Calculate the predicted value of the house at the start of 2021, giving your answer correct to **4** significant figures.

£……..…….…… **[2]**

(e).

i. Compared with its value at the start of 2017, show that the formula predicts the house will have doubled in value at some point during 2032.

[3]

ii. Give **one** reason why this may not happen.

_____

_____ **[1]**

56(a). y is inversely proportional to the square root of x.
$y = 6$ when $x = 49$.

Find a formula linking x and y.

..... **[3]**

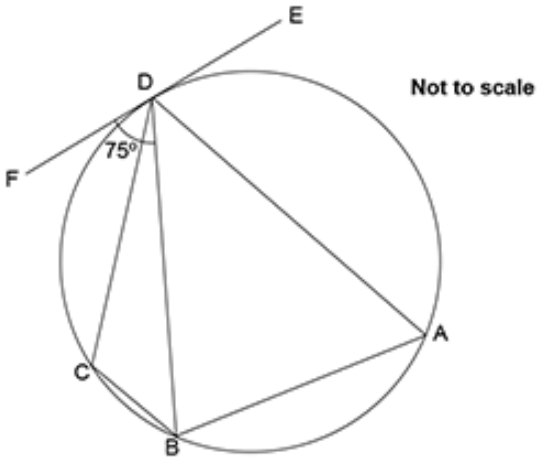
(b). Find the value of x when $y = 30$.

$x =$ ..... **[3]**

57. A, B, C and D are points on the circumference of a circle.

EF is the tangent to the circle at D.

Angle BDF = 75°.



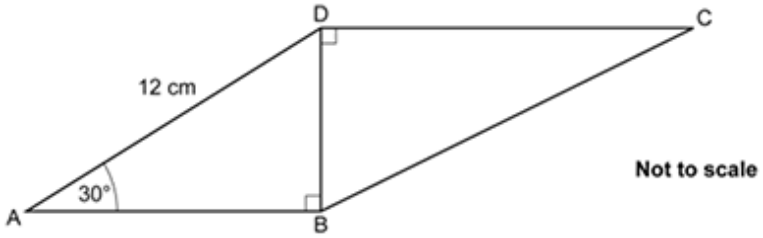
The ratio angle BCD : angle CBD is 7 : 3.

Work out angle CBD.
You must show your working.

…….° **[5]**

58. The diagram shows a quadrilateral ABCD.

AD = 12 cm, angle BAD = 30° and angle ABD = angle BDC = 90°.



The ratio of length DC to length DB is $\frac{4}{3}$: 1.

Work out length BC.
You must show your working.

…….…….…… cm **[7]**

59. Blake invests £8000 at a simple interest rate of *r* % each year.
After 5 years the value of their investment is £8900.

Find the value of *r*.

r = …….…….…… **[4]**

60(a). The formula

$P = 8500 \times 1.054^n$

is used to predict the population, P, of an island n years after 2019.

Write down the population of the island in 2019.

…… **[1]**

(b). Write down the percentage growth rate used in the formula.

……% **[1]**

(c).

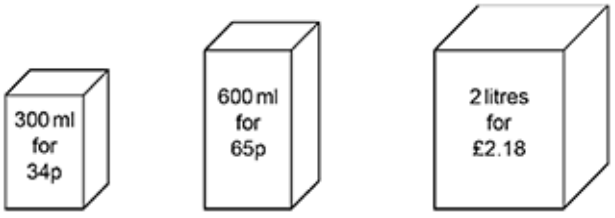
i. Work out the population predicted by the formula for the year 2030.

…… **[2]**

ii. Give one reason why the answer to **(i)** may **not** be reliable.

---**[1]**

61(a). A shop sells the same milk in three different sized cartons.
The diagram shows the price of each carton.



A student only buys milk on a Saturday morning.
They use 275 ml of milk each day.
Any unused milk has to be thrown away at the end of the following Friday.

Show that it is cheaper for the student to buy the milk they need in 2 litre cartons than in 600 ml cartons.

[3]

(b). Which carton is the best value for money?
Show how you decide.

[3]

62. Hiro invests £2500 for 2 years in a bank account paying *r* % per year compound interest.
At the end of 2 years, the amount in the bank account is £2704.

Calculate *r*.

r = ... **[4]**

63. A large box of chocolates contains dark, milk and white chocolates.
When Riley opens the box, the ratio of dark to milk to white chocolates is 3 : 2 : 4.
Riley's family eat 6 of the dark chocolates, none of the milk chocolates and all of the white chocolates.
The ratio of dark to milk chocolates is now 9 : 8.

How many **white** chocolates did Riley's family eat?

..... white chocolates **[4]**

64(a). x and y are related by the equation $xy = 36$.

Tick the correct statement.

- ☐ y is directly proportional to x
- ☐ y is inversely proportional to x
- ☐ y is not proportional to x

[1]

(b). y is inversely proportional to x^4.
$y = 2.5$ when $x = 2$.

Find a formula linking x and y.

..... **[3]**

65. y is directly proportional to the cube of x.

Complete the table.

x	1	2	
y	7		875

[4]

66(a). A biologist assumes the population, P, of birds on an island can be predicted using the formula

$P = 3800 \times 1.042^{n}$

where n is the number of years after the start of 2020.

Write down the percentage increase per year that is used in the formula.

..... % **[1]**

(b). Calculate the predicted population at the start of 2024.

..... **[2]**

(c).

i. Show that the number of birds is predicted to exceed 7000 during 2034.

[3]

ii. A researcher says that between 2022 and 2030 the percentage increase per year in the population will be 2.8%.

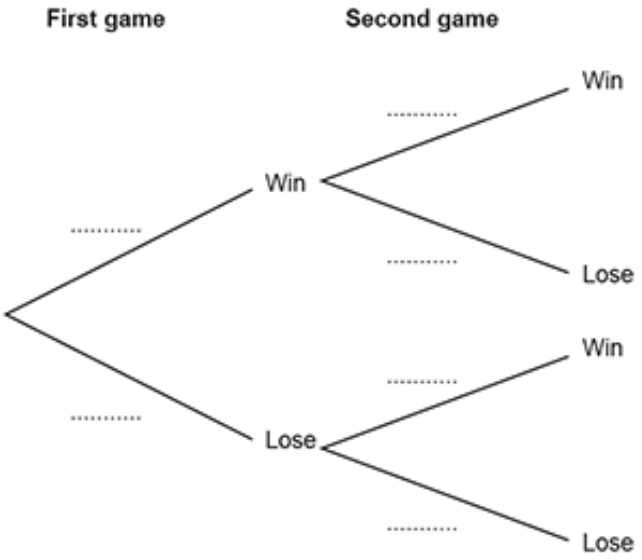
If the researcher is correct, explain how this new information will affect the answer in part **(i)**.

---**[1]**

67(a). In a computer game the player can either win or lose.
A student thinks the ratio of the probability of winning to the probability of losing is 2 : 3.

The student plays two games.

Use the information to complete the tree diagram.



[3]

(b). Find the probability that the student wins at least one of the two games

..... **[3]**

(c). The student now thinks the ratio of the probability of winning to the probability of losing has changed to 2 : 5.

Explain the effect this change will have on your answer to the part above.

---

[1]

68. y is inversely proportional to the square root of x.
$y = 7$ when $x = 144$.

Find the value of y when $x = 16$.

$y =$ ..... **[3]**

69(a). Alex invests £4500 at a rate of 7.5% per year simple interest.

Find the value of the investment at the end of 4 years.

£ ..... **[3]**

(b). At the end of t years, the value of the investment is over £13 500 for the first time.

Find the value of t.

t = ... **[3]**

70(a). The price of a seat on a flight, £P, is given by

$P = 49 \times 1.009^n$

where n is the number of seats already sold on this flight.

Write down the percentage increase in price of the second seat sold compared to the first seat sold.

..... % **[1]**

(b). Show that the price of the 40th seat sold is less than £70.

[2]

71. It takes 40 minutes to fill a garden pond using water from 5 identical hose pipes.

Assuming the rate of flow of water from each hose pipe is the same, work out how many minutes it would take to fill the same garden pond using 2 of these hose pipes.

..... minutes **[2]**

72. On Heidi's bookcase, the ratio of fiction to non-fiction books is 2 : 3.
Heidi removes 2 fiction books from the bookcase.
The ratio of fiction to non-fiction books is then 5 : 8.

How many books are left on the bookcase in total?

..... books **[4]**

73. Taylor has a full bottle of medicine.
The bottle holds 20 doses of medicine.

Each day Taylor takes one dose of medicine out of the bottle.
After 8 days, there are 180 millilitres of medicine left in the bottle.

Work out how many millilitres of medicine the bottle holds when full.

..... ml **[4]**

74. A zoo counts its animals.
The ratio of antelope to zebra is 3 : 2.
The ratio of meerkats to zebra is 7 : 3.

There are 15 more meerkats than antelope.

Work out the number of zebra in the zoo.

..... **[4]**

75. y is directly proportional to the square of x.

Find the percentage decrease in y when x is decreased by 30%.

..... % **[4]**

76(a). The time taken to paint a wall is inversely proportional to the number of people painting.
It takes 40 minutes for 3 people to paint the wall if nobody stops painting.

Layla, Mia and Nina start painting the wall.
After 10 minutes Layla stops painting.
She leaves Mia and Nina to finish painting the wall.

Assume that Layla, Mia and Nina paint at the same rate.

Work out the **total** time taken to paint the wall.

..... minutes **[3]**

(b). y is inversely proportional to x^3.
$y = 16$ when $x = 2$.

Find the value of y when $x = 8$.

..... **[3]**

77. The number of bees, P, in a colony is given by the formula

$P = ab^x$

where x is the number of months after the start of July.

At the start of July, there were 25 000 bees in the colony.
After one month, there were 23 500 bees in the colony.

Find the value of a and the value of b.
Give the value of b as a decimal.

a = ...
b = ... **[4]**

78. y is directly proportional to $\sqrt{x}$.
$y = 1$ when $x = 16$.

Find a formula for y in terms of x.

..... **[3]**

79(a). An estimate for the number of seals on an island is given by the formula

$P = 5200 \times 1.02^t$

where P is the number of seals t years after the start of year 2015.

Write down the annual percentage increase in the number of seals on the island.

..... **[1]**

(b). Use the formula to show that there may have been about 4700 seals on the island at the start of year 2010.
[2]

80(a). Li bought a house at the start of 2016.
Li assumes the value of the house, £V, can be predicted using the formula

$V = 185000 \times 1.035^{n}$

where n is the number of years after the start of 2016.

Explain how you know that the value of the house is predicted to increase each year.

---**[1]**

(b). Write down the percentage increase per year that is used in the formula.
..... % **[1]**

(c). Write down the value of the house at the start of 2016.
(c) £..... **[1]**

(d). Calculate the predicted value of the house at the start of 2020, giving your answer correct to **4** significant figures.

(d) £ ..... **[2]**

(e).

i. Compared with its value at the start of 2016, show that the formula predicts the house will have doubled in value at some point during 2036.

[3]

ii. Give **one** reason why this may not happen.

---**[1]**

81. Amir, Beth and Charlie work in a cafe.
Customers give spare change as tips.
At the end of each week, Amir, Beth and Charlie share the total amount of tips between them in the ratio matching the number of hours they worked that week.

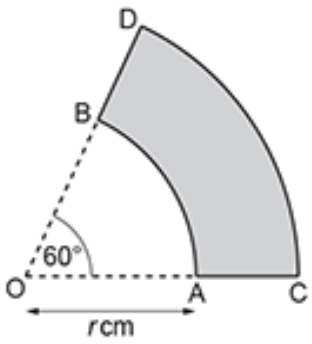
This week:

- Amir's share of the tips was £25.40.
- Beth worked twice as many hours as Amir.
- Charlie worked 5 more hours than Amir.
- The total hours worked by Amir, Beth and Charlie was 85 hours.

Calculate the total amount of tips received this week.
You must show your working.

£..... **[6]**

82. The diagram shows a shaded shape made by removing sector OAB from sector OCD.
Both sectors have an angle of 60°.
The radius, OA, of the smaller sector is r cm.
The ratio of radius OA to radius OC is 2 : 3.



Not to scale

Work out, in terms of π and r, the **total** length of arc AB and arc CD.
Give your answer in its simplest form.
You must show your working.

..... cm **[5]**

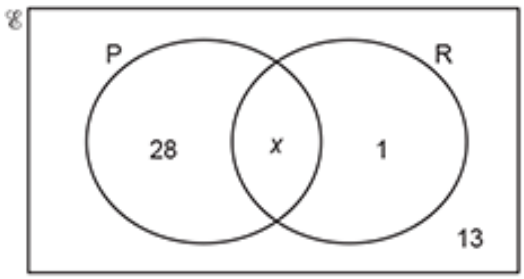
83. y is inversely proportional to x^2.
$y = 9$ when $x = 2$.

Find the value of y when $x = 10$.

$y =$ ..... **[3]**

84(a). In a survey about music, some students were asked whether they like pop (P) and whether they like rap (R).

The Venn diagram shows some of the results.
x students liked both types of music.



The ratio of the number of students who liked pop to the number who liked rap was 5 : 2.

Work out the **total** number of students in the survey.

(a) ..... **[4]**

(b). One of the students is selected at random.

Find the probability that this student does **not** like rap given that they like pop.

..... **[2]**

85. Recipes measure small quantities in teaspoons and tablespoons.
3 teaspoons is equivalent to 1 tablespoon.

A cake recipe uses $\frac{3}{4}$ of a teaspoon of salt and 1 tablespoon of baking powder.

The ratio of salt to baking powder used in the recipe can be written in the form 1 : n.

Find the value of n.

n = ... **[3]**

86(a). y is inversely proportional to the square root of x. $y = 5$ when $x = 36$.

Find a formula linking x and y.

..... **[3]**

(b). Find the value of x when $y = 20$.

$x =$ ..... **[3]**

87(a). Azmi, Beth and Callum share a flat.

The monthly rent is £760.
They share the rent in the ratio 2 : 3 : 3.

How much does Beth pay for rent each month?

£ ..... **[2]**

(b). Azmi, Beth and Callum share the fuel bill in the ratio 2 : 3 : 3.
Callum pays £36 for fuel each month.

How much does Azmi pay for fuel each month?

£ ..... **[2]**

88. A bag of sweets contains jellies, mints and toffees.

The ratio of jellies to mints is n : 2.
The ratio of mints to toffees is 5 : 3n.

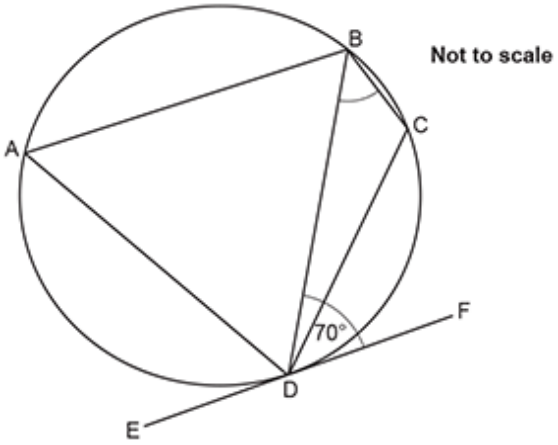
Work out the ratio of jellies to toffees.
Give your answer in its simplest form.

..... : ..... **[4]**

89. A, B, C and D are points on the circumference of a circle.

EF is the tangent to the circle at D.

Angle BDF = 70°.



The ratio angle BCD : angle CBD is 5 : 2.

Work out angle CBD.
You must show your working.

..... ° **[5]**

90. A car mechanic has a tin containing 5 litres of engine oil.
Each week they use 450 millilitres of this oil for their vehicles.

The car mechanic says

After 9 weeks I will have used over 80% of the oil in this tin.

Are they correct?
Show how you decide.

[5]

91. A worker received a 10% pay increase in 2017 and a further 10% pay increase in 2018.
The worker says

Over these two years, my pay increased by 10% + 10% = 20%.

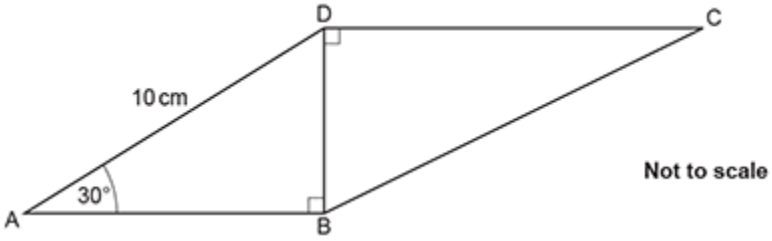
The worker is incorrect.

Work out the correct percentage increase.
You must show your working.

[5]

92. The diagram shows a quadrilateral ABCD.

AD = 10 cm, angle BAD = 30° and angle ABD = angle BDC = 90°.



The ratio of length BD to length DC is 1 : 2.4 .

Work out length BC.
You must show your working.

..... cm **[7]**

93(a). The formula

$P = 6800 \times 1.045^n$

is used to predict the population, P, of an island n years after 2018.

Write down the population of the island in 2018.

..... **[1]**

(b). Write down the percentage growth rate used in the formula.

..... % **[1]**

(c).

i. Work out the population predicted by the formula for the year 2030.

(i) .....**[2]**

ii. Give **one** reason why the answer to **(i)** may **not** be reliable.

[1]

94(a). A shop sells the same milk in three different sized cartons.
The diagram shows the price of each carton.

Which carton is the best value for money?
Show how you decide.

[3]

(b). A student only buys milk on a Saturday morning.
They use 120 ml of milk each day.
Any unused milk has to be thrown away at the end of the following Friday.

Show that it is cheaper for the student to buy the milk they need in 300 ml cartons than in 500 ml cartons. **[3]**

95. Jamie invests £6000 at a simple interest rate of r% each year.
After 6 years the value of their investment is £7170.

Find the value of r.

r = ... **[4]**

END OF QUESTION PAPER