

# **National 4**

## **N4 Expressions and Formulae Unit Test**

### **Preparation Booklet 1**

## Formulae list

Circumference of a circle:  $C = \pi d$

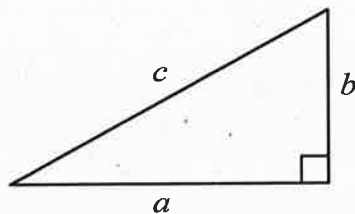
Area of a circle:  $A = \pi r^2$

Curved surface area of a cylinder:  $A = 2\pi r h$

Volume of a cylinder:  $V = \pi r^2 h$

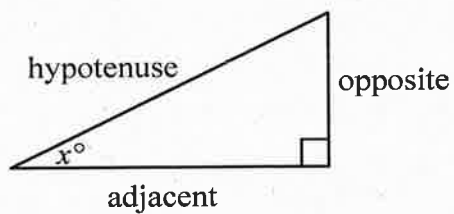
Volume of a prism:  $V = Ah$

Theorem of Pythagoras:



$$a^2 + b^2 = c^2$$

Trigonometric ratios in a right angled triangle:

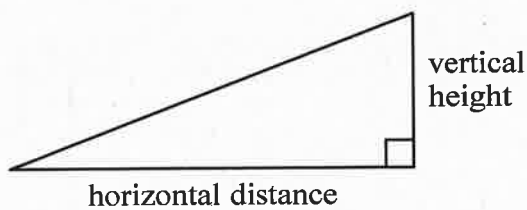


$$\tan x^\circ = \frac{\text{opposite}}{\text{adjacent}}$$

$$\sin x^\circ = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\cos x^\circ = \frac{\text{adjacent}}{\text{hypotenuse}}$$

Gradient:



$$\text{Gradient} = \frac{\text{vertical height}}{\text{horizontal distance}}$$

### Exercise 1

1. Expand the brackets:

(a)  $4(2x + 3)$  (b)  $5(3a - 2)$  (c)  $3(4 + 5y)$  (d)  $2(2e + 4)$  (e)  $6(3p - 1)$

2. Expand the brackets and simplify:

(a)  $3(4y + 1) + 2y$  (b)  $2(3x + 2) + 6x$  (c)  $4(a + 2) + 5$  (d)  $3(2f - 4) - 4f$

(e)  $5(2k - 1) - 3k$  (f)  $4(2y + 5) - 9$  (g)  $3(2m - 1) - 3$

### Exercise 2

1. Factorise:

(a)  $2x + 10$  (b)  $3k + 12$  (c)  $10g + 15$  (d)  $12p - 8$  (e)  $8w - 10$

### Exercise 3

1. Simplify:

(a)  $3y + 5z + 6y - 2z$  (b)  $6m + 8n + 4m - 3n$  (c)  $9t + 7u - 6t - 2u$

(d)  $5a + 4b - 3a + 2b$  (e)  $8g + 7h - 5g + 6h$  (f)  $7c + 9d - 6c + 9d$

### Exercise 4

1. When  $x = 4$  and  $y = 7$ , find the value of:

(a)  $5x - 2y$  (b)  $6x - 3y$  (c)  $3y - 5x$  (d)  $4y - 2x$  (e)  $7x - 3y$

2. (a) Peter works part-time in a mobile phone shop. His weekly pay is calculated using the formula:

$$P = 5.5H + 10M$$

Where  $P$  is his pay (in pounds),  $H$  is the hours that he works, and  $M$  is the number of mobile phones that he sells.

One week he works for 20 hours and sells 12 mobile phones.

Calculate his pay for that week.

(b) John works at a car wash. His weekly pay is calculated using the formula:

$$P = 3.5H + 2.5C$$

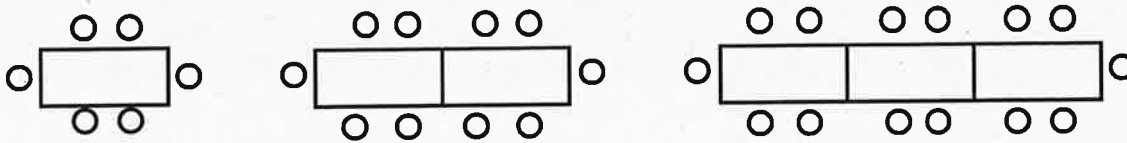
Where  $P$  is his pay (in pounds),  $H$  is the hours that he works, and  $C$  is the number of cars that he washes.

One week he works for 12 hours and washes 50 cars.

Calculate his pay for that week.

**Exercise 5**

1. The diagram below shows the seating arrangements for the dining room of a hotel. There is only one size of table and chairs available.

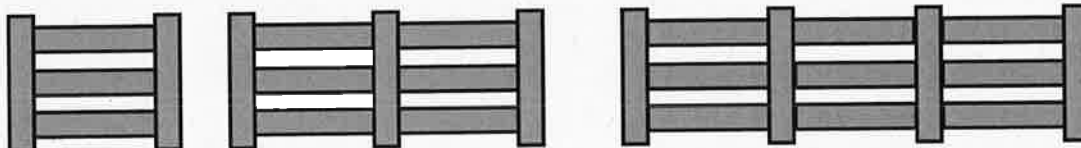


(a) Complete the table below.

Number of Tables (T)	1	2	3	4	5		10
Number of Chairs (C)	6	10					

- (b) Write a formula for calculating the number of chairs (C) when you know the number of tables (T).
- (c) An arrangement has 78 chairs. How many tables does it have? You must show your working.

2. The diagram below shows a panelled fence using planks of wood. The planks are arranged horizontally and vertically as shown.



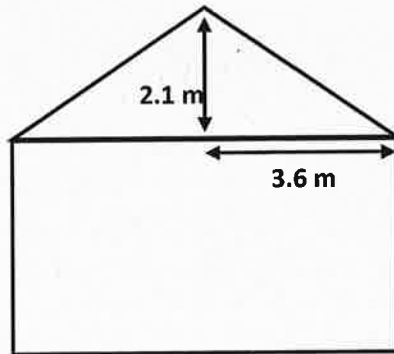
(a) Complete the table below.

Number of Panels (P)	1	2	3	4	5		10
Number of Planks of Wood (W)	5	9					

- (b) Write a formula for calculating the number of planks of wood (W) when you know the number of panels (P).
- (c) A fence is made from 97 planks of wood. How many panels does it have? You must show your working.

Exercise 6

1. The roof of a new house is being designed. To meet safety regulations, the slope must have a gradient of less than 0.6. An outline of the plans is shown below.

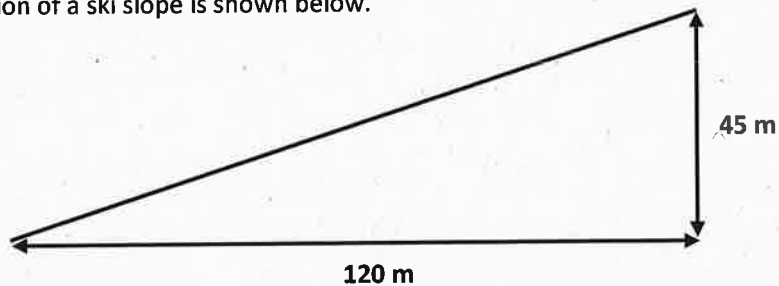


- (a) Calculate the gradient of the slope.  
(b) Does this slope meet the regulations?

Give a reason for your answer.

2. The difficulty of a ski slope is graded blue (easy) or black (hard) depending on the steepness of the slope. A section is classed as difficult if it has a gradient of greater than 0.4.

A section of a ski slope is shown below.



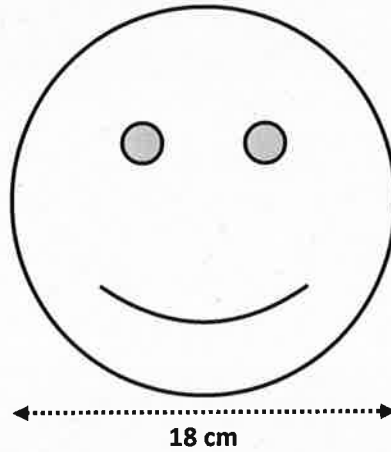
- (a) Calculate the gradient of the slope.  
(b) Should this section of the slope be graded as black (hard)?

Give a reason for your answer.

Exercise 7

1. The diagram shows a new sign.

The sign is in the shape of a circle with a smiley face design. The circle has a diameter of 18cm, as shown below.



- (a) Calculate the circumference of the front of the sign.  
(b) Calculate the area of the front of the sign.

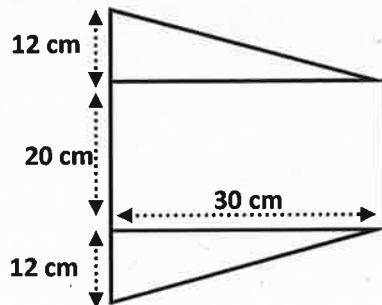
2. The plaque on a new trophy is in the shape of a circle. The circle has a diameter of 3.2cm, as shown below.



- (a) Calculate the circumference of the front of the plaque.  
(b) Calculate the area of the front of the plaque.

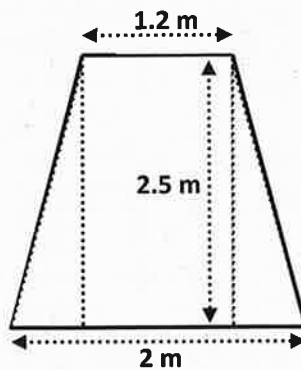
Exercise 8

1. A flag is in the shape of a trapezium. The trapezium is made up of a rectangle and two identical right-angled triangles. An outline of the flag is shown below.



Find the area of the flag.

2. The entrance to a coal mine is in the shape of a trapezium. The trapezium is made up of a rectangle and two identical right-angled triangles. An outline of the entrance is shown below.

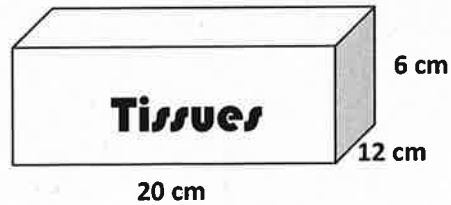


Find the area of the entrance to the coal mine.

Exercise 9

1. A tissue box is in the shape of a cuboid.

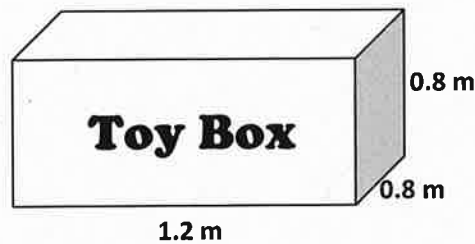
The cuboid is 20cm long, 12cm wide and 6cm high, as shown in the diagram below.



Find the surface area of the cuboid shown.

2. A toy box is in the shape of a cuboid.

The cuboid is 1.2m long, 0.8m wide and 0.8m high, as shown in the diagram below.

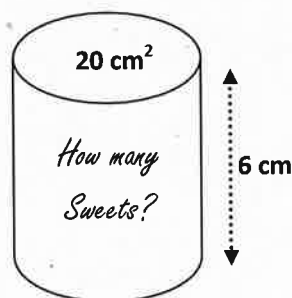


Find the surface area of the cuboid shown.

Exercise 10

1. A container in the shape of a cylinder is used to store sweets for a competition.

The area of the base of the container is  $20 \text{ cm}^2$ . The height of the container is 6 cm high.

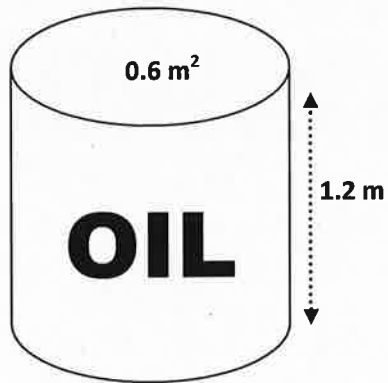


Calculate the volume of the container.



2. An oil barrel is in the shape of a cylinder.

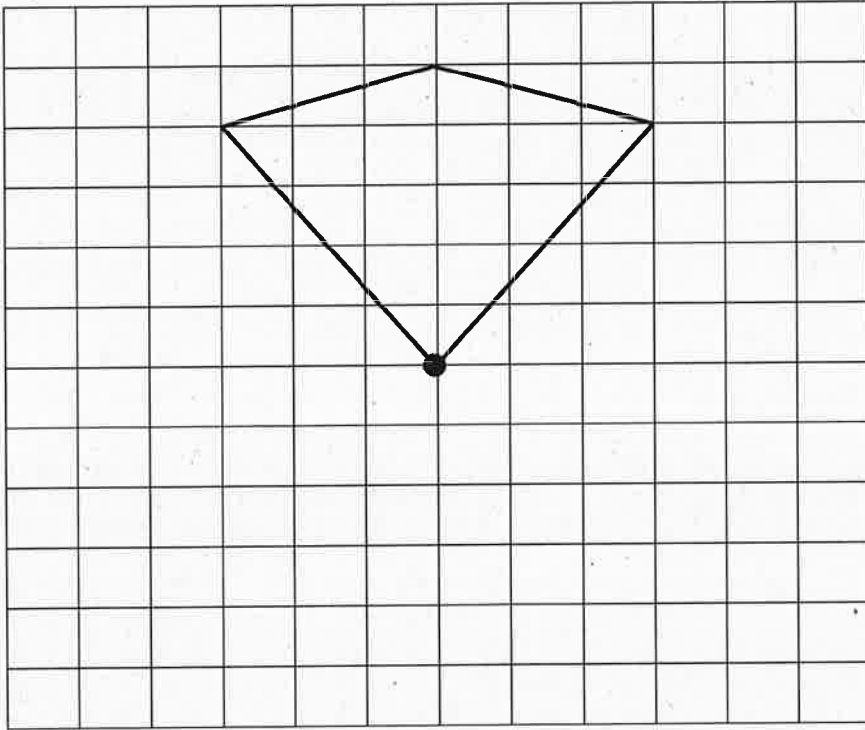
It has a base of area  $0.6 \text{ m}^2$  and a height of  $1.2 \text{ m}$ .



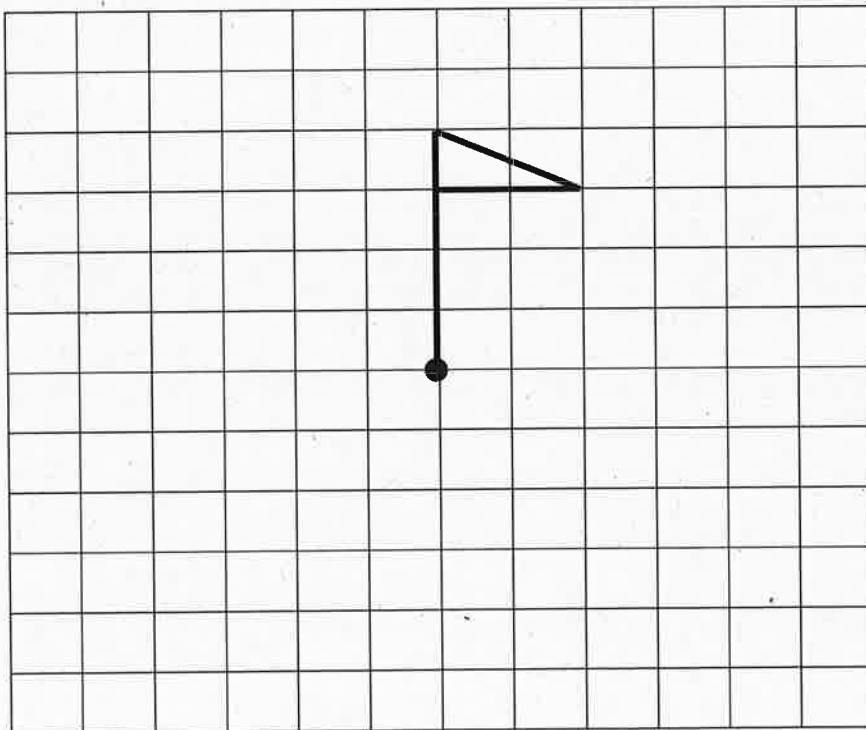
Calculate the volume of the barrel.

Exercise 11

1. Complete each design so that it has rotational symmetry of order 4, about O.



2. Complete the design so that it has rotational symmetry of order 4, about O.





Exercise 13

1. A sample of pupils were given a French vocabulary test and their results recorded.

The results are shown below.

6	3	7	9	5
4	5	7	8	6

(a) Calculate the mean test score.

(b) Calculate the range.

Each pupil was then given time to revise before sitting a similar vocabulary test.

In the second test, the mean was 8 and the range was 4.

(c) Write two comments comparing the results in the first test compared to the results in the second test.

2. A short survey recorded the ages of the first 8 people to enter a library on a Monday morning at 9am.

The results, in years, are shown below.

25	58	78	50
57	64	40	4

(a) Calculate the mean age of visitors.

(b) Calculate the range of ages.

A second survey was taken of the first 8 people to enter the same library at 8pm on the same day.

In the second survey, the mean was 36 and the range was 20.

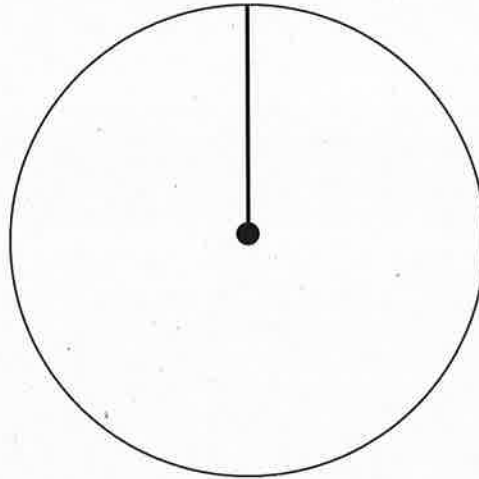
(c) Write two comments comparing the results in the first survey compared to the results in the second survey.

Exercise 14

1. Sixty pupils were asked where they went on holiday.

Complete the table below and use the information to draw a pie chart for the data.

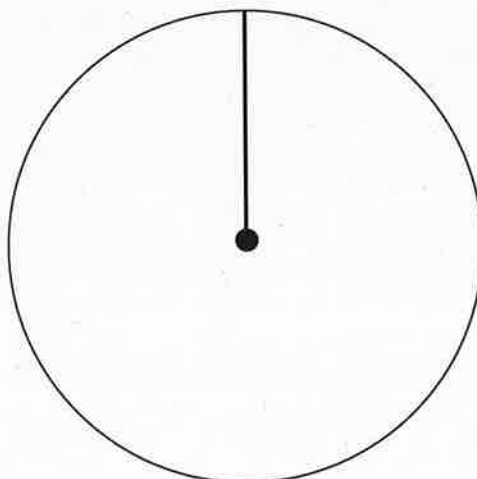
<u>Holiday Location</u>	<u>No. Of Pupils</u>	<u>Angle at the centre</u>
UK	30	
Europe	20	
North America	5	
Other	5	



2. Forty pupils were asked what type of pets they owned.

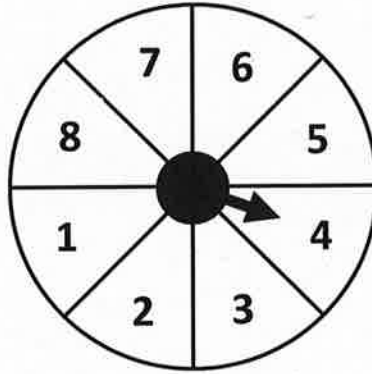
Complete the table below and use the information to draw a pie chart for the data.

<u>Pet</u>	<u>No. Of Pupils</u>	<u>Angle at the centre</u>
Dog	16	
Cat	12	
Fish	4	
Other	8	



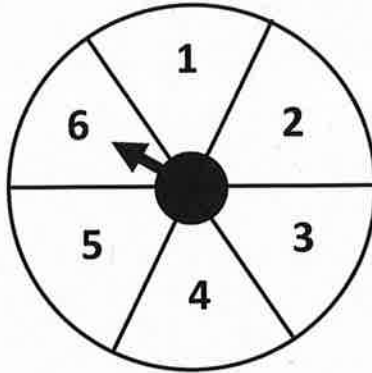
Exercise 15

1. A spinner is spun.



What is the probability that the arrows stops on a number greater than 5?

2. A spinner is spun.



What is the probability that the arrow stops on a number less than 4.

Answers- N4 Expressions and Formulae Unit Test- Preparation Booklet 1

Exercise 1

- 1) a)  $8x + 12$  b)  $15a - 10$  c)  $12 + 15y$  d)  $4e + 8$  e)  $18p - 6$   
2) a)  $14y + 3$  b)  $12x + 4$  c)  $4a + 13$  d)  $2f - 12$  e)  $7k - 5$   
f)  $8y + 11$  g)  $6m - 6$

Exercise 2

- 1) a)  $2(x + 5)$  b)  $3(k + 4)$  c)  $5(2g + 3)$  d)  $4(3p - 2)$  e)  $2(4w - 5)$

Exercise 3

- 1) a)  $9y + 3z$  b)  $10m + 5n$  c)  $3t + 5u$  d)  $2a + 6b$  e)  $3g + 13h$   
f)  $c + 18d$

Exercise 4

- 1) a) 6 b) 3 c) 1 d) 20 e) 7  
2) a) £230 b) £167

Exercise 5

- 1) a)

Number of Tables (T)	1	2	3	4	5		10
Number of Chairs (C)	6	10	14	18	22		42

- b)  $C = 4T + 2$  c) 19 Tables

- 2) a)

Number of Panels (P)	1	2	3	4	5		10
Number of Planks of Wood (W)	5	9	13	17	21		41

- b)  $W = 4P + 1$  c) 24 Panels

Exercise 6

- 1) a)  $\frac{7}{12}$  b) Yes as  $\frac{7}{12} < 0.6$   
2) a)  $\frac{3}{8}$  b) No as  $\frac{3}{8} < 0.4$

Exercise 7

1) a)  $56.55\text{cm}$       b)  $254.47\text{cm}^2$

2) a)  $10.05\text{cm}$       b)  $8.04\text{cm}^2$

Exercise 8

1)  $960\text{cm}^2$     2)  $4\text{m}^2$

Exercise 9

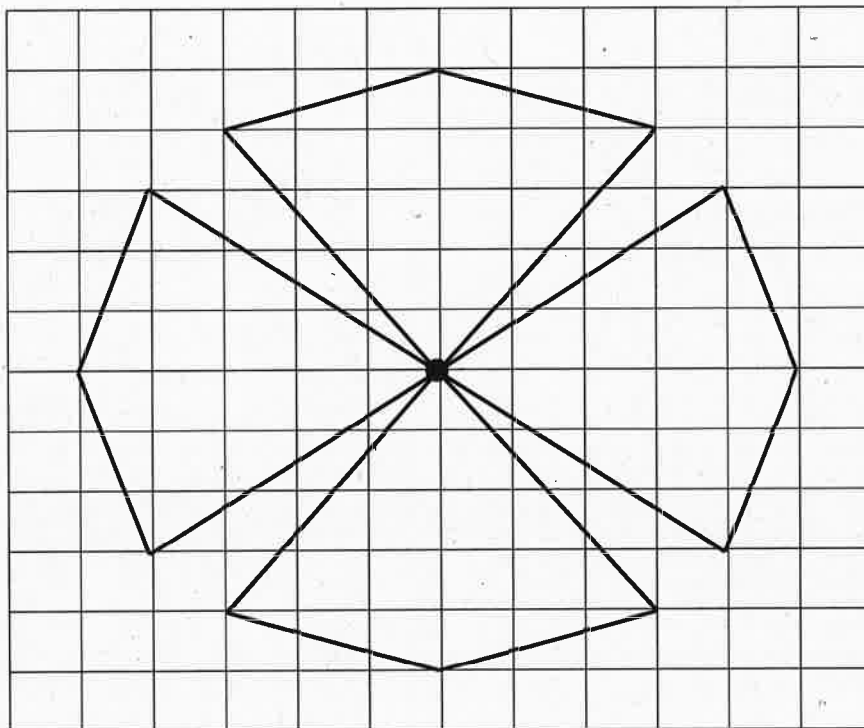
1)  $864\text{cm}^2$     2)  $5.12\text{m}^2$

Exercise 10

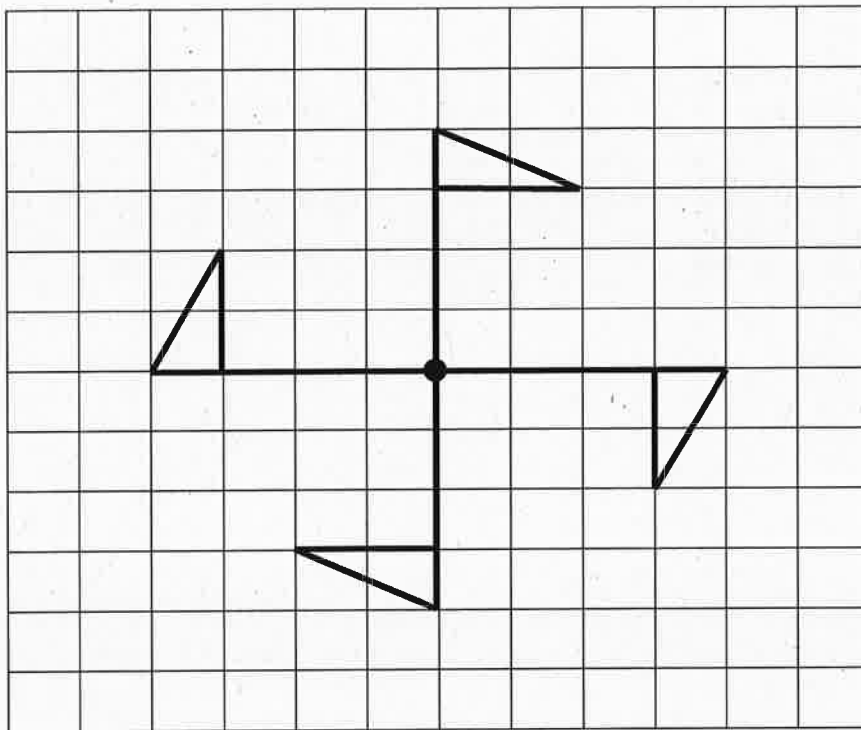
1)  $120\text{cm}^3$     2)  $0.72\text{m}^3$

Exercise 11

1)







**Exercise 12**

1)

Birds	Frequency
0-9	1
10-19	4
20-29	4
30-39	5
40-49	2
	<b>Total= 16</b>

2)

Goals	Frequency
30-39	2
40-49	5
50-59	5
60-69	2
70-79	4
80-89	2
	<b>Total= 20</b>

**Exercise 13**

1) a) Mean =  $\frac{60}{10} = 6$     b) Range =  $9 - 3 = 6$

c) On average results were better in test 2 as mean was 8 compared to 6 in test 1.

The results were less spread out in test 2 as the range was 4 compared to 6 in test 1.

2) a) Mean =  $\frac{376}{8} = 47$     b) Range =  $78 - 4 = 74$

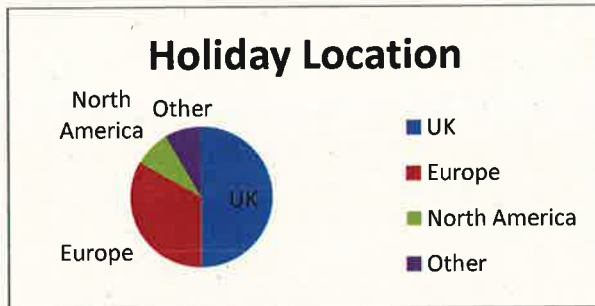
c) On average people in survey 1 were older as the mean was 47 compared to 36 in test 2.

The results were less spread out in survey 2 as the range was 20 compared to 74 in test 1.

**Exercise 14**

1)

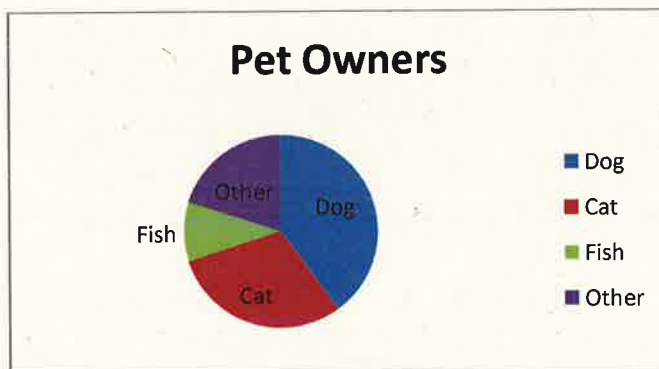
<u>Holiday Location</u>	<u>No. Of Pupils</u>	<u>Angle at the centre</u>
UK	30	$\frac{30}{60} \times 360 = 180^\circ$
Europe	20	$\frac{20}{60} \times 360 = 120^\circ$
North America	5	$\frac{5}{60} \times 360 = 30^\circ$
Other	5	$\frac{5}{60} \times 360 = 30^\circ$



- Pie chart drawn with angles correct to  $\pm 2$  degrees.
- Labels included.

2)

<u>Pet</u>	<u>No. Of Pupils</u>	<u>Angle at the centre</u>
Dog	16	$\frac{16}{40} \times 360 = 144^\circ$
Cat	12	$\frac{12}{40} \times 360 = 108^\circ$
Fish	4	$\frac{4}{40} \times 360 = 36^\circ$
Other	8	$\frac{8}{40} \times 360 = 72^\circ$



- Pie chart drawn with angles correct to  $\pm 2$  degrees.
- Labels included.

**Exercise 15**

1)  $Prob(> 5) = \frac{3}{8}$       2)  $Prob(< 4) = \frac{3}{6} = \frac{1}{2}$