Armadale Academy

S3 Mathematics

National 5 Preparation Assessment

1. Rounding and significant figures

Video: Answers:

Question 1:   Round each of the following numbers to 1 significant figure

(a) 36   (b) 22   (c) 83   (d) 68   (e) 97   (f) 120   (g) 519

(h) 260   (i) 741   (j) 888   (k) 408   (l) 650   (m) 148   (n) 972

(o) 3900   (p) 5400   (q) 4125   (r) 2732   (s) 6349   (t) 8099   (u) 6499

Question 2:   Round each of the following numbers to 1 significant figure

(a) 12000   (b) 46000   (c) 74500   (d) 83771   (e) 95120   (f) 330000

(g) 863000   (h) 248220   (i) 489331   (j) 13800000

Question 3:   Round each of the following numbers to 1 significant figure

(a) 2.9   (b) 3.2   (c) 5.7   (d) 46.81   (e) 57.25   (f) 80.96   (g) 94.9

(h) 115.1   (i) 8.482   (j) 13.65   (k) 66.321   (l) 5501.4   (m) 48.02   (n) 99.99

Question 4:   Round each of the following numbers to 1 significant figure

(a) 0.54   (b) 0.86   (c) 0.161   (d) 0.048   (e) 0.0943   (f) 0.0071   (g) 0.0038

(h) 0.06482   (i) 0.8835   (j) 0.00064   (k) 0.00098   (l) 0.00002789

Question 5:   Round each of the following numbers to 2 significant figures

(a) 844   (b) 665   (c) 129   (d) 2840   (e) 9250   (f) 1359   (g) 298

(h) 504   (i) 999   (j) 3841   (k) 48500   (l) 13.7   (m) 58.3   (n) 49.6

(o) 1.41   (p) 42.64   (q) 0.3189   (r) 22490   (s) 186110   (t) 0.04912   (u) 4.98

(v) 997826   (w) 2.99517   (x) 0.06014

2. Percentages

Video:

Question 1: Paul leaves £4000 in the bank for two years.
It earns compound interest of 5% per year.
Calculate the total amount Paul has in the bank at the end of the two years.

Question 2: The population of birds on an island is estimated to increase by 10% every year.
The population of birds on the island is 20000.
Calculate an estimate for the population of birds in three years time.

Question 3: The value of a car decreases by 5% each year.
Sophie bought a car two years ago for £10000
Work out the value now.

Question 4: Sam invests £1800 in the bank for four years.
It earns compound interest of 4% each year.
Calculate the total amount Sam has in the bank at the end of four years.

Question 5: A full water tank holds 500 litres.
The tank begins to leak water and is losing 14% of its contents every hour.
Find how much water is left in the tank after 8 hours.

Question 6: The height of a tree increases by 60% each year.
When planted the tree was 40cm tall.
How tall will the tree be in 5 years time.

3. Speed, Distance, Time

Video:

Question 1: Convert the times from hours/minutes into hours, without a calculator.
e.g. 1   45 minutes = 0.75 hours
e.g. 2   1 hour 30 minutes = 1.5 hours

(a) 15 minutes
(b) 30 minutes
(c) 45 minutes
(d) 20 minutes
(e) 40 minutes
(f) 2 hours 30 minutes
(g) 1 hour 15 minutes
(h) 3 hours 45 minutes
(i) 2 hours 40 minutes
(j) 5 hours 30 minutes
(k) 7 hours 20 minutes
(l) 4 hours 15 minutes

Question 2: Convert the times from hours/minutes into hours.
You may use a calculator if needed.

(a) 18 minutes
(b) 54 minutes
(c) 1 hour 3 minutes
(d) 1 hour 36 minutes
(e) 2 hours 48 minutes
(f) 2 hours 33 minutes
(g) 8 hours 51 minutes
(h) 3 hours 21 minutes
(i) 27 minutes

Question 3: Convert the times from hours/minutes into hours.
Give each answer to 3 decimal places.

(a) 44 minutes
(b) 8 minutes
(c) 1 hour 50 minutes
(d) 2 hours 10 minutes
(e) 4 hours 26 minutes
(f) 3 hours 29 minutes
(g) 5 hours 2 minutes
(h) 2 hours 55 minutes
(i) 59 minutes

Question 4: Convert the times from hours into hours/minutes, without a calculator.

(a) 0.75 hours
(b) 1.25 hours
(c) 5.5 hours
(d) 1.3333... hours
(e) 2.6666... hours
(f) 10.75 hours
(g) 3.25 hours
(h) 0.5 hours
(i) 22.3333... hours

Question 1: Calculate the average speeds for each of the following, without using a calculator.

(a) A car travels 60 miles in 2 hours
(b) A lorry travels 120 miles in 3 hours
(c) A cyclist travels 45 miles in 5 hours
(d) A jogger travels 30km in 4 hours
(e) A runner runs 100 metres in 10 seconds
(f) A car travels 195 miles in 3 hours
(g) A helicopter travels 425 miles in 5 hours
(h) A helicopter flies 840 miles in 7 hours
(i) A dog runs 216 metres in 12 seconds
(j) An airplane travels 984 miles in 6 hours
(k) A bird flies 19 miles in 2 hours
(l) A car travels 600km in 8 hours

Question 2: Calculate the average speeds for each of the following, without using a calculator.

(a) A car travels 20 miles in 30 minutes
(b) A lorry travels 32 miles in 30 minutes
(c) A bird flies 17 kilometres in 30 minutes
(d) A man jogs 2 kilometres in 15 minutes.
(e) A helicopter flies 18 miles in 15 minutes
(f) An F1 car travels 32 miles in 15 minutes.
(g) A dog runs 3 kilometres in 10 minutes
(h) A jet travels 23 miles in 6 minutes.
(i) A car travels 12 miles in 20 minutes
(j) A car travels 9 miles in 12 minutes
(k) A motorcycle travels 36 miles in 40 minutes
(l) A car travels 27 kilometres in 45 minutes.

4.   Statistics

Median and Interquartile Range

Find the median and IQR:

1.   2, 4, 5, 7, 9, 10, 12

2.   13, 14, 14, 15, 15, 18, 21

3.   11, 18, 12, 15, 12, 23, 25, 21, 20

4.   1, 7, 2, 11, 9, 3, 1, 6, 10, 7, 8

5.   53, 52, 34, 25, 57, 44, 58, 37, 54

6.   51, 48, 50, 54, 37, 33

Median and IQR

Mean and Standard Deviation

Calculate the mean and standard deviation of each:

1.   14, 17, 15, 23, 20, 19

2.   8, 13, 7, 6, 8, 9, 5

3.   1.8, 3.7, 4, 2.6, 5.9

4.   102, 108, 112, 109, 110, 107

5.   47, 56, 61, 52, 59

6.   1, 2, 4, 1, 3, 2, 1

Formulae

$$s = \sqrt{\frac{\sum (x - \bar{x})^2}{n - 1}}$$

Or

$$= \sqrt{\frac{\sum x^2 - (\sum x)^2 / n}{n - 1}}$$

Mean and Standard Deviation

PROBABILITY

1.   A number is picked at random from the numbers 0, 1, 2, 3, 4, 5, 6, 7, 8, 9.
       What is the probability that the number picked is:

       (a)   less than 6   (b)   greater than 7?

2.   In a game of Scrabble, the word below is worth 11 points.

W_3 I_1 N_2 N_2 E_1 R_2

The above tiles are put in a bag and one tile is picked out without looking.
What is the probability that the tile picked out is:

       (a)   an N   (b)   worth 2 points   (c)   a vowel?

3. A basket contains 16 eggs. 4 are brown and the rest are white. 5 eggs are cracked and one is bad.
Find the probability that an egg picked at random will be:

(a) brown　　　　　　(b) white　　　　　　(c) bad　(d) **not** cracked?

4. (a) In a word game, a letter is chosen at random from the word PERCENTAGE.
What is the probability that the letter chosen is an E?

(b) Later in the game, a letter is chosen at random from the word PARALLEL.
What is the probability that the letter chosen will be an A?

5. There are 1 blue, 2 red and 3 yellow counters in a bag.

(a) A counter is taken from the bag at random.
What is the probability that the counter is red?

(b) The counter is replaced in the bag and two green counters are added to the bag. Another counter is then taken from the bag.
What is the probability that this counter is **not** yellow?

5.   Volume

<u>Formulae</u>   Volume of a sphere $V = \frac{4}{3}\pi r^3$ Volume of a cone $V = \frac{1}{3}\pi r^2 h$

Volume of a pyramid $V = \frac{1}{3}Ah$

1.

A traffic bollard is in the shape of a cylinder with a hemisphere on top.

The bollard has

- diameter 24 centimetres
- height 70 centimetres.

70 cm

24 cm
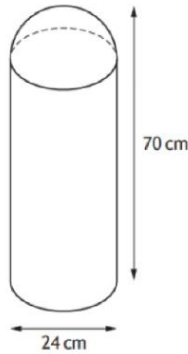
Calculate the volume of the bollard.

Give your answer correct to 3 significant figures.

Volume of Cylinder

Volume of Cone

2.   A toy company makes juggling balls in the shape of a sphere with a diameter of 6·4 centimetres.

Volume of Pyramid

6·4 cm
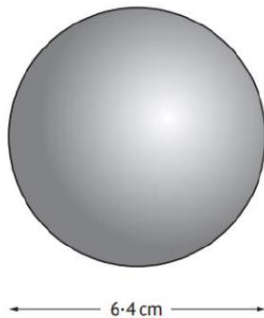
Calculate the volume of one juggling ball.

Give your answer correct to 2 significant figures.

Volume of Sphere

3.   A spherical sweet is made by coating a caramel sphere evenly with chocolate.

A cross-section of the sweet is shown below.

3 mm

24 mm

Composite Volume
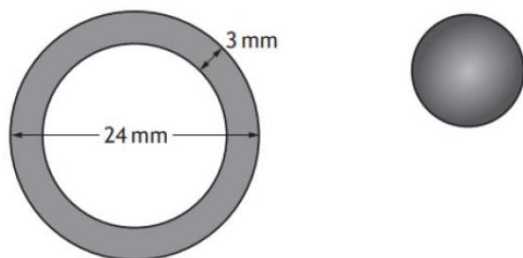
The diameter of the sweet is 24 millimetres and the thickness of the chocolate coating is 3 millimetres.

Calculate the volume of the chocolate coating.

Give your answer correct to 3 significant figures.

4. A child's toy is in the shape of a hemisphere with a cone on top, as shown in the diagram.

The toy is 10 centimetres wide and 16 centimetres high.

Calculate the volume of the toy.

Give your answer correct to 2 significant figures.

16 cm

10 cm
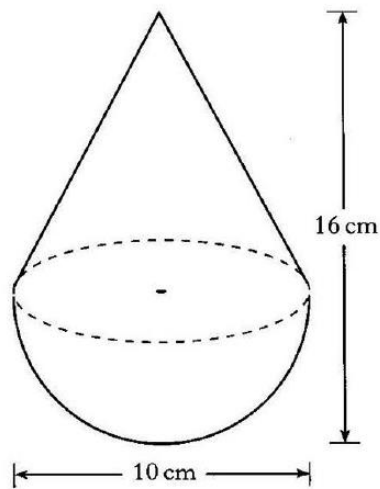
6. Algebra

Expanding brackets

(a) 5(y + 3)   (b) 4(a + 2)   (c) 8(w + 10)   (d) 3(x – 7)

(e) 9(s – 1)   (f) 2(8 – t)   (g) 7(4 + h)   (h) 10(a + 2b + 3c)

(i) 4(3y + 2)   (j) 5(2p – 1)   (k) 3(7a + 2)   (l) 9(2x – 5)

(m) 5(4 + 3t)   (n) 7(9 – 2c)   (o) 8(3w + 1)   (p) 9(1 – 4p)

(q) 11(2k – 5)   (r) 20(6a + 5c)   (s) 3(15w – 7)   (t) 3(9 – 2a)

Question 5:   Expand and simplify

(a) 5(y + 3) + 2(y + 7)   (b) 6(2w + 5) + 9(w + 2)   (c) 3(y – 2) + 4(2y + 5)

(d) 7(2g + 3) – 5(g+ 2)   (e) 6(x – 2) – 4(x – 8)   (f) 2(3y – 8) – 5(2y – 1)

(g) 8(5 + 2m) + 3(5 – 3m)   (h) 4(w + 7) – 2(2w + 1)   (i) 9(1 + 2y) + 3(3 – y)

Factorising

Question 1: Factorise the following expressions

(a) 4x + 6   (b) 15x + 20   (c) 9y – 12   (d) 5x + 15

(e) 6x – 3   (f) 4x + 8   (g) 5y – 25   (h) 8w + 24

Question 2: Factorise the following expressions

(a) $x^2 + 7x$ (b) $x^2 – 3x$ (c) $y^2 + y$ (d) $w^2 + 9w$

(e) $x^2 – 7x$ (f) $4w^2 + 10w$ (g) $6x^2 – 8x$ (h) $9y^2 – 6y$

Highest Common Factor

Equations

(a) 2x + 3 = 9   (b) 3w – 1 = 14   (c) 7y + 2 = 30

(d) 5x + 20 = 35   (e) 6c - 12 = 48   (f) 8m – 4 = 20

(g) 7w + 13 = 90   (h) 12p – 18 = 30   (i) 9w – 5 = 67

(j) 10a + 40 = 100   (k) 9x – 24 = 84   (l) 7w + 1 = 1

(a) $4x + 1 = 2x + 7$ (b) $5x + 4 = 3x + 16$ (c) $2x + 8 = x + 12$

(d) $7x + 1 = 2x + 46$ (e) $6x – 3 = 2x + 13$ (f) $9x – 10 = 7x + 24$

(g) $2x + 21 = 4x + 5$ (h) $x + 2 = 5x – 2$ (i) $6x – 9 = 4x – 1$

7. Arc Length and Sector Area

Sector Area

Question 1: Calculate the area of each of the following sectors.
Give each answer to one decimal place and include units.

(a)

6cm

(b)

15cm

(c)

120°

8cm

(d)

2cm

60°

(e)

36°

7m

(f)

72°

35cm
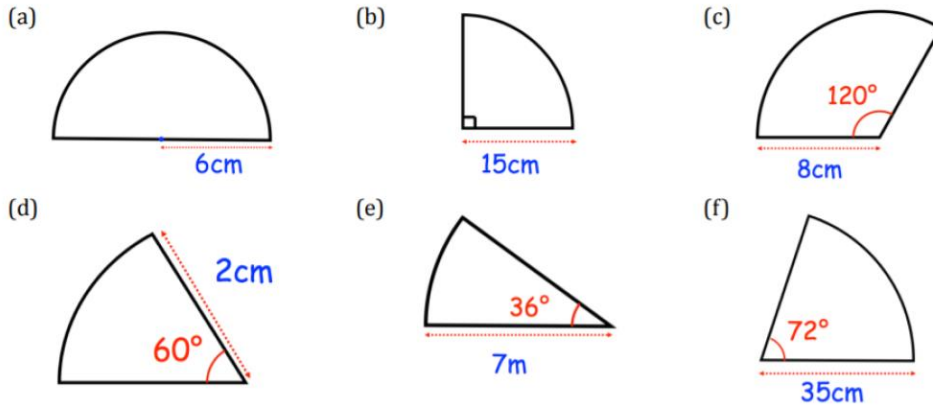
Arc Length

Question 1: For each sector below, calculate the length of the arc.
Give your answers to one decimal place and include suitable units.

(a)

6cm

(b)

120°

15cm

(c)

30°

4m

(d)

72°

20cm
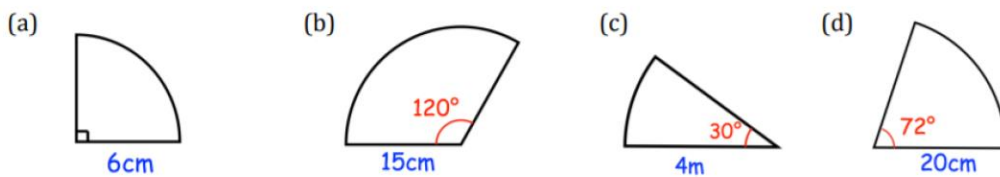
Question 2: For each sector below, calculate the length of the arc.
Give your answers to one decimal place and include suitable units.

(a)

14°

8cm

(b)

150°

19cm

(c)

73°

25.2cm

(d)

235°

60cm
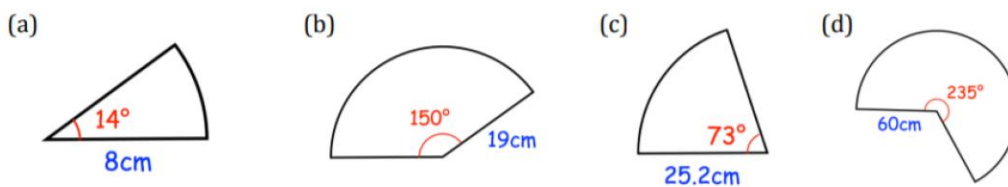
8. Gradient

Question 1:   Find the gradient of each of these lines

(a)
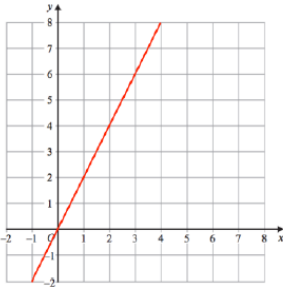
(b)
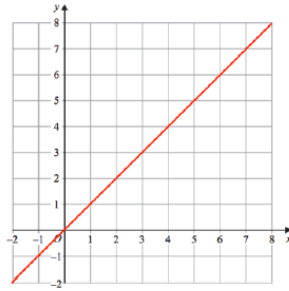
(c)
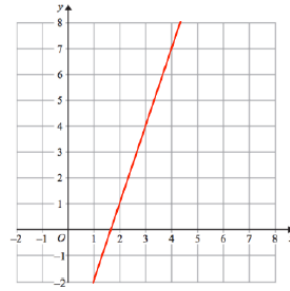
(d)
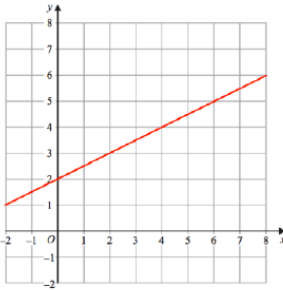
(e)
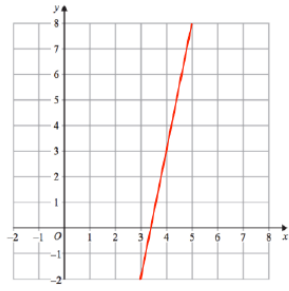
(f)
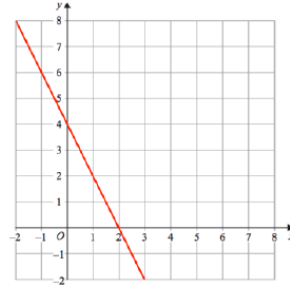
9. Money

Hire Purchase

Currency

Hire Purchase

1)

Emily's car insurance will cost £1280

She pays a deposit of £430 and then pays 10 equal monthly

How much is each monthly payment?

2)

Luis bought a new washing machine.

He paid a deposit of £300.
Luis then paid £40 each month for the next 6 months.

How much did he pay in total?

3)

A holiday costs £1670

Lorenzo will pay a deposit of £250
He will then pay the rest of the cost in 8 equal monthly payments.

Work out the amount of each monthly payment.

4)

Henry buys a new computer that costs £1800

He pays a 15% deposit.
Henry pays the rest of the cost in 12 equal monthly payments.

How much is each monthly payment?

Currency

Question 1: Nicola went to Italy. She changed £800 into euros (€).
The exchange rate was £1 = €1.40
Change £800 into euros.

Question 2: A new TV in Tokyo costs ¥53380
The exchange rate is £1 = ¥157
How much is the TV in pounds?

Question 3: In Lisbon, a watch costs €80.
In Liverpool, the same watch costs £65.
The exchange rate is £1 = €1.25

Work out the difference in cost.

10. Ratio

Simplifying   Calculations   Sharing

1.   In a cat and dog home, the ratio of cats to dogs is 25 : 40.
        Write this ratio in its simplest form.

2.   The ratio of men to women at a party is 3 : 2.
        If there are 18 men at the party, how many women are there?

3.   Alex and James share £160 in the ratio 5 : 3.
        How much will each person receive?

4.   The ratio of three people's wages is 450 : 300 : 250.
        Write this ratio in its simplest form.

5.   The ratio of vowels to consonants in a book is 4 : 9.
        If there are 12 000 vowels in the book, how many consonants are there?

6. Ed, Ted and Zed £200 in the ratio 2 : 3 : 5.
How much will each person receive?

7. At a Tennis and Golf Club, the ratio of tennis players to golfers is 90 : 150.

(a) Write the ratio of tennis players to golfers in its simplest form.

(b) The club has been given £16 000.
This money will be divided between the tennis section and the golf section in the same ratio as above.
How much money will be allocated to each section?

11. Similarity

Sides   Area   Volume

Question 1: Below are pairs of similar shapes.
Find the missing lengths.

(a)

cm
8cm
6cm
3cm

(b)

15cm
5cm
4cm   cm

(c)

5cm
4cm
cm
20cm
16cm
12cm

(d)

15cm
2.5cm
1.5cm   cm

(e)

cm
9cm
12cm   60cm

(f)

6.5cm
6cm
cm
1.3m
1.2m
50cm
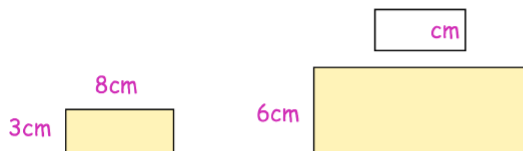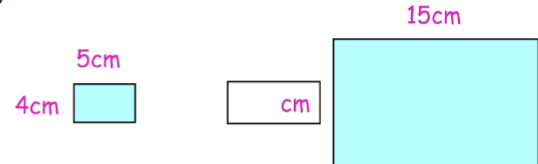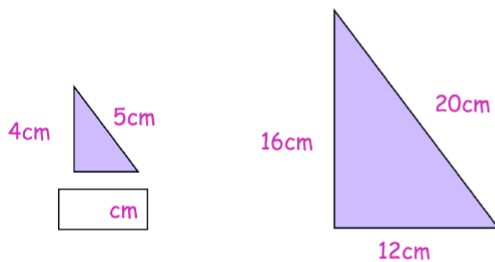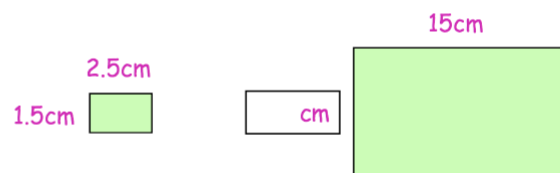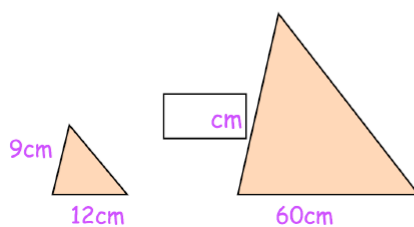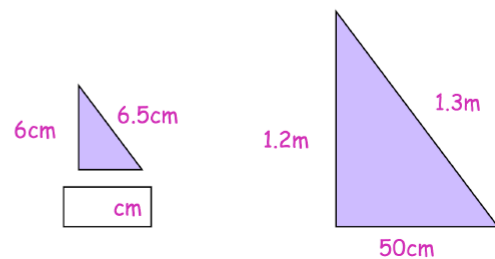
Question 3:   Each pair of shapes below are similar.
              Find the missing areas.

Area = ☐ cm²

(a)
Area = ☐ cm²

Area = 5cm²

A

B

2cm

6cm

(b)   Area = 80cm²

7cm

14cm

(c)
Area = 240cm²

Area = ☐ cm²

5cm

20cm

(d)
Area = ☐ cm²

Area = 4cm²

1.5cm

9cm

Question 3:   The solids below are mathematically similar.
              Find the missing volumes.

(a)   Volume = ☐ cm³

Volume = 20cm³

3cm

9cm

(b)   Volume = 160000cm³

Volume = ☐ cm³

5cm

40cm

(c)   Volume = ☐ cm³   Volume = 138.24cm³

5cm

6cm

(d)   Volume = ☐ mm³

Volume = 65mm³

2.5mm

1cm

12. Angles in a circle

Question 1:   Find the missing angles labelled in each of these circles

(a)
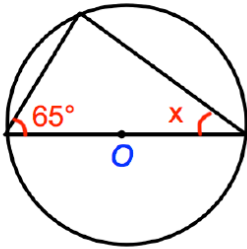
(b)
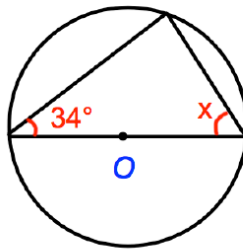
(c)
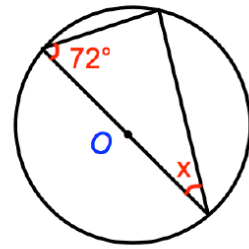
(m)
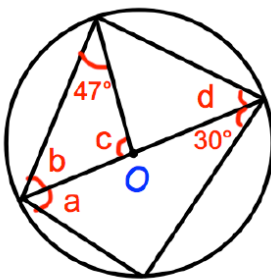
(n)
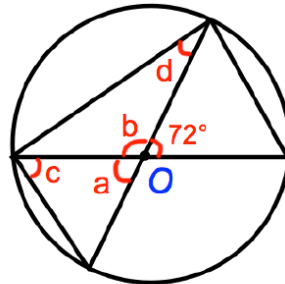
(o)
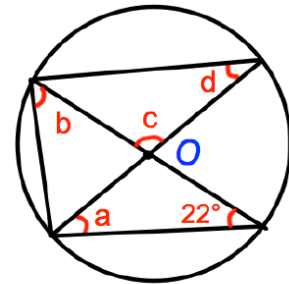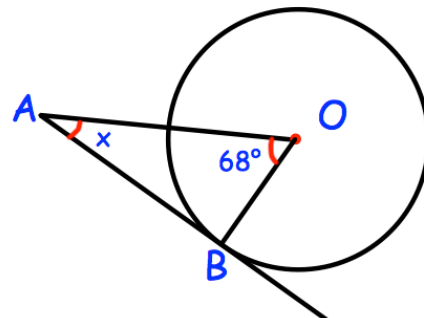

Question 10: Find the value of x in each diagram. The lines AB and AC are tangents.
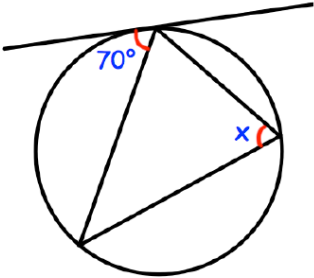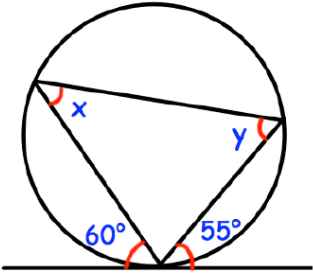
(a)
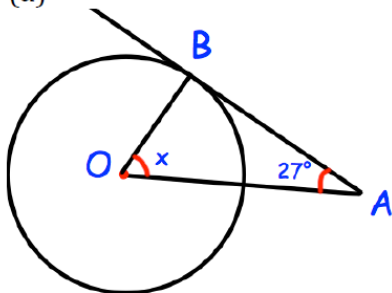
(b)

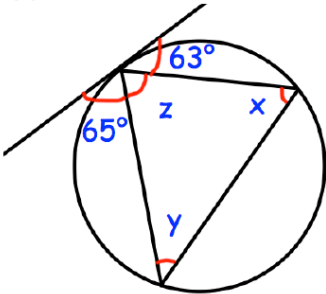Question 13: Find the missing angles labelled in each of these circles

(a)

(b)

(c)

(d)

(e)

(f)