

National 5 Mathematics Homework

Exercise 11



Solving Quadratics

1. Solve the following quadratic equations by factorising:-

(a) $4x^2 - 36 = 0$

(b) $x^2 + 8x + 12 = 0$

(c) $2x^2 - 11x + 12 = 0$ (7)

2. Solve the following quadratic equation using the formula, correct to 2dp

(a) $x^2 + 7x + 4 = 0$

(b) $3a^2 - 12a + 11 = 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

(9)

3. Find the discriminant for each of these and use it to determine the nature of the roots:-

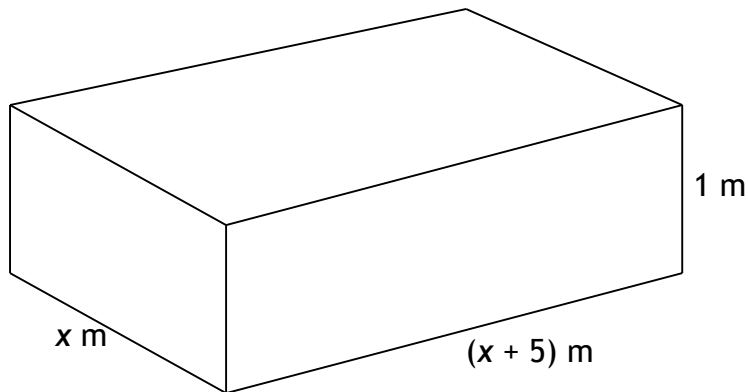
(a) $x^2 + 10x + 25 = 0$

(b) $4x^2 + 9x + 6 = 0$

(8)

4. If $ax^2 + 6x + 1 = 0$ has one real root find the value of a. (3)

5. A cuboid is shown below.



It has length $(x + 5)$ metres, breadth x metres, height 1 metres and volume 24 cubic metres.

(a) Show that $x^2 + 5x - 24 = 0$

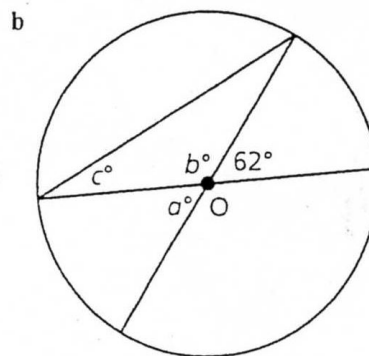
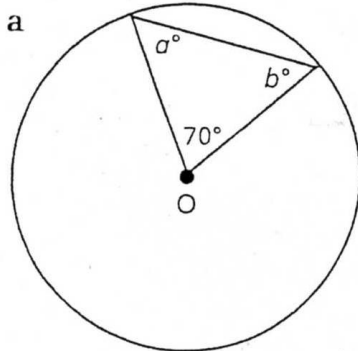
(b) Using the equation in part (a), find the breadth of the cuboid. (6)

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Exercise 12

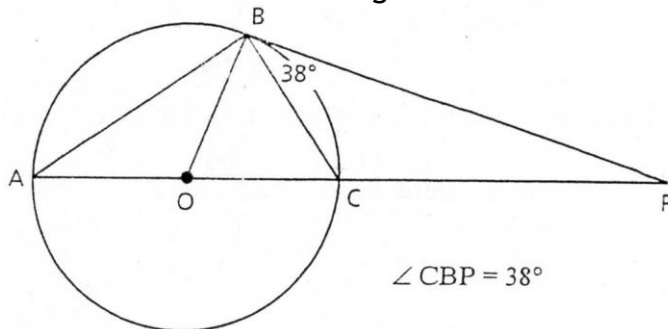


Angles in Circles

1. Calculate the size of the angles marked a, b and c in each diagram. (5)

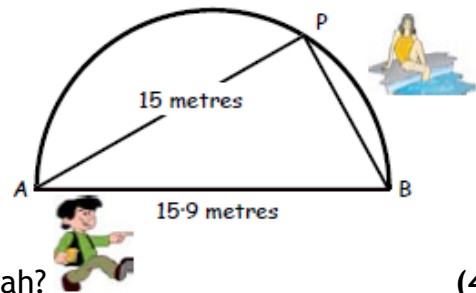


2. In the diagram PB is a tangent to the circle. Calculate the size of angle BAC. (3)



3. A swimming pool, in the shape of a semi-circle, has diameter 15.9 metres.

Donald swam from A to P.
Sarah swam from P to B.



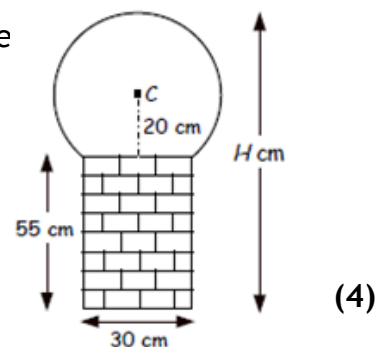
How much further had Donald travelled than Sarah? (4)

4. Sophie built a small tower, made of bricks, in her back garden. On top of it she fitted a large glass light-bulb holder.

The diagram shows it as part of a circle.

Centre, C, is 20 centimetres above the top of the wall.

Find the total height of the structure, H.



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Exercise 13



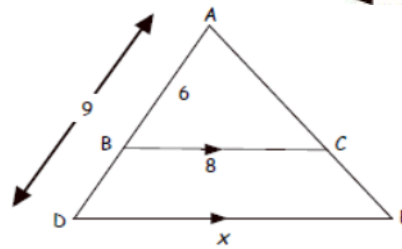
Similar Shapes

1. A birthday cake is baked in two sizes, both similar to each other. The large cake has a 30cm base and is 36cm in height.



Calculate the height of the smaller cake which has a 20cm base.

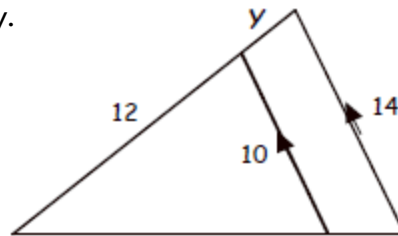
2. In the triangle shown, BC is parallel to DE. Triangle ABC is similar to triangle ADE.



Calculate the value of x .

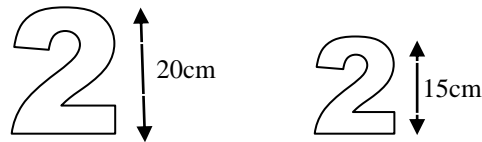
(3)

3. In the triangle shown, calculate the length of y .



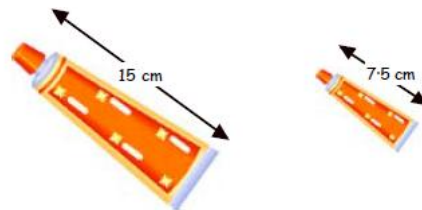
(3)

4. The two “number 2’s” are similar. The large “two” has a surface area of 80cm^2 and is 20cm tall. If the small “two” is 15cm tall, what will the surface area be? (4)



5. The diagram shows two tubes of toothpaste. The two tubes are mathematically similar. The length of the big toothpaste is 15cm and the length of the smaller one 7.5cm.

If the big tube has a volume of 150ml, what will the volume of the small tube be?



(4)

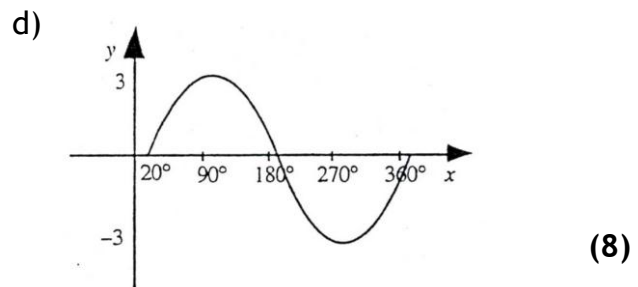
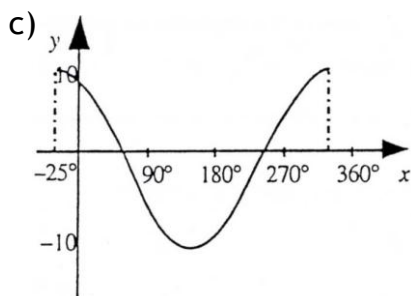
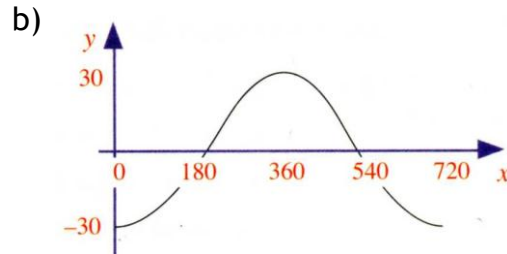
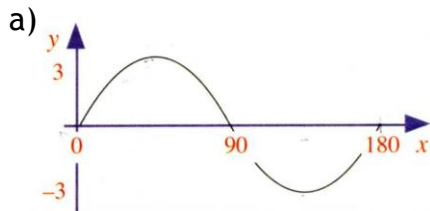
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Exercise 14



Trig Graphs and Equations

1. Write down the equations of the trigonometric functions associated with the following graphs:



(8)

2. Make neat sketches of the following trigonometric functions, clearly indicating the main points and features.

a) $y = 5\sin 2x$

b) $y = 0.2\cos 5x$

c) $y = 10\sin(x + 20)$ (10)

3. Solve the following trigonometric equations in the range $0 \leq x \leq 360$

a) $4\sin x - 1 = 0$

b) $7\cos x + 4 = 0$

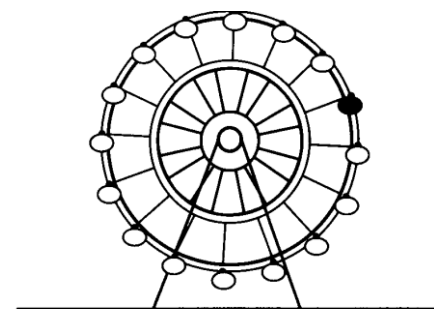
c) $10\tan x + 8 = 3\tan x + 4$ (10)

4. At the carnival, the height, H metres, of a carriage on the big wheel above the ground is given by the formula

$$H = 10 + 5\sin t^\circ, \quad t \text{ seconds after turning.}$$

a) Find the height of the carriage above the ground after 10 seconds.

b) Find **two** times during the first turn of the wheel when the carriage is 12.5 metres above the ground.



(6)

Remember:- $\sin^2 x + \cos^2 x = 1$ and $\tan x = \frac{\sin x}{\cos x}$

5. Simplify the following using the above 2 identities:-

a) $15\sin^2 x + 15\cos^2 x$

b) $\frac{-3\sin x}{4\cos x}$

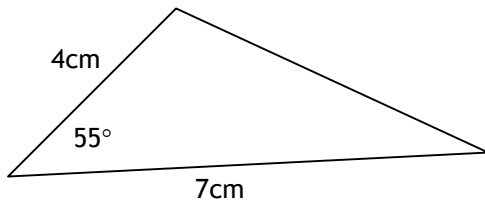
c) $\frac{1 - \sin^2 x}{4\cos^2 x}$ (5)

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Exercise 15



Trigonometry

1. Calculate the area of this triangle: - (3)



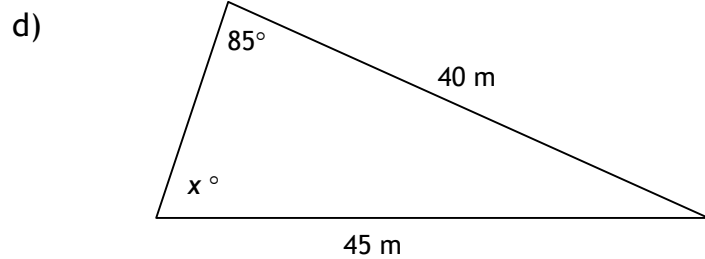
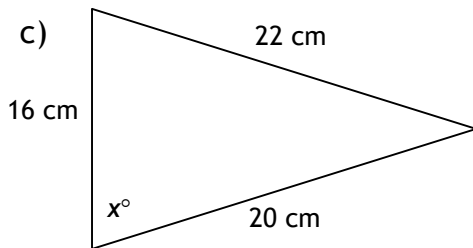
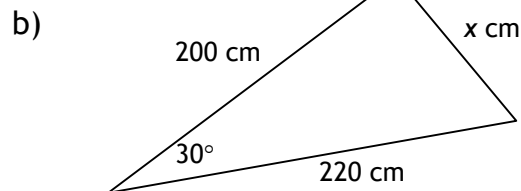
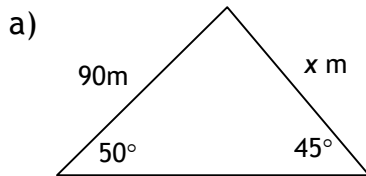
$$\text{Area of triangle} = \frac{1}{2} ab \sin C$$

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - (2bc \cos A)$$

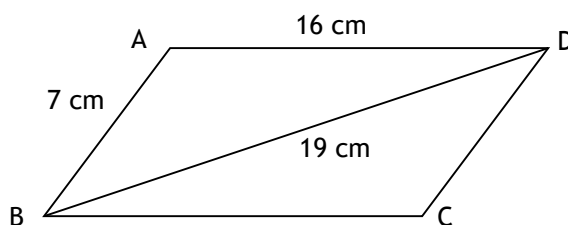
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

2. Find x in each of the following questions:-



(14)

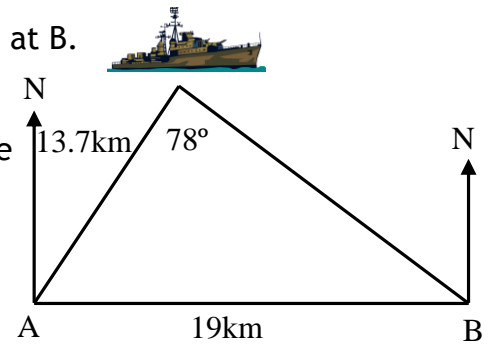
3. The sketch shows parallelogram, ABCD.



- Calculate the size of angle ABD.
- Hence calculate the area of the parallelogram.

(6)

4. A coastguard at A is 19 kilometres due west of a coastguard at B.
A tanker is spotted at T, such that angle ATB is 78°
The tanker is 13.7 km away from point A.
If the tanker is on a bearing of 040° from A find the distance
from the tanker to the coastguard at point B



(3)