



2018 Year 11 math topic test: Trigonometry and circle mensuration © itute 2018

Q1 A hiker travels S 25° W for 3 km from Camp C to Waterfall W , then N 65° W for 4 km to Lookout L and then 5 km E to quarry Q .

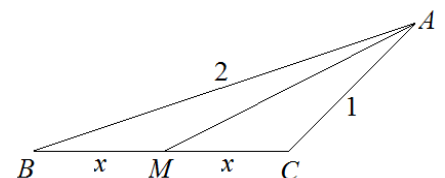
a. Draw a clear, neat and labelled diagram showing the route of the hiker. 3 marks

b. Calculate the straight line distance (km) of Quarry Q from Camp C to 2 decimal places. 2 marks

c. Calculate the compass bearing (degrees) of Camp C from Lookout L to 2 decimal places. 2 marks

Q2 In the following diagram, M is the midpoint of BC , $AM = BC = 2x$, $AB = 2$ and $AC = 1$.
Let $\angle AMC = \theta$.

a. Use the cosine rule to write an equation for x in terms of θ . 2 marks



b. Use the cosine rule to write a second equation for x in terms of θ . 2 marks

c. Solve the equations in part a and part b as two simultaneous equations to find the exact value/s of x . 3 marks

d. Find the exact value of $\cos \theta$. 1 mark

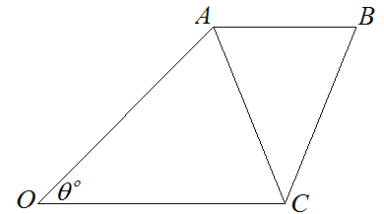
Q3 The following diagram shows two **similar** triangles together forming quadrilateral $OACB$, where $OA = OC$ and $CA = CB$. Let $\angle AOC = \theta^\circ$.

a. Express $\angle OCA$ in terms of θ° .

1 mark

b. Use the sine rule to find the value of ratio $CA : OA$ in terms of θ° , given $\sin \theta = 2 \sin \frac{\theta}{2} \cos \frac{\theta}{2}$.

2 marks



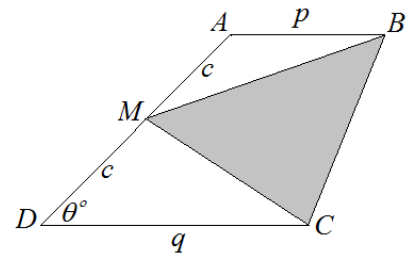
c. Hence find the value of ratio $\text{area of } \triangle CAB : \text{area of } \triangle OCA$ in terms of θ° .

2 marks

Q4 $ABCD$ is a trapezium in the diagram shown below, where $AB \parallel DC$. Let $AB = p$, $DC = q$, $AM = MD = c$ and $\angle ADC = \theta^\circ$.

a. Find the area of trapezium $ABCD$ in terms of p , q , c and θ° .

2 marks



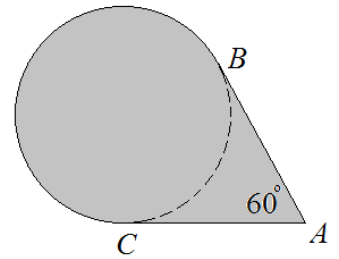
b. Find the total area of $\triangle CDM$ and $\triangle BAM$ in terms of p , q , c and θ° .

3 marks

c. Hence show that the area of $\triangle BMC$ (shaded) equals the total area of $\triangle CDM$ and $\triangle BAM$. 2 marks

Q5 The shaded area in the following diagram is enclosed by major arc BC , tangents AB and AC . $\angle BAC = 60^\circ$. Let the radius of the circle be r units.

- a. Find the length of chord BC in terms of r . 2 marks

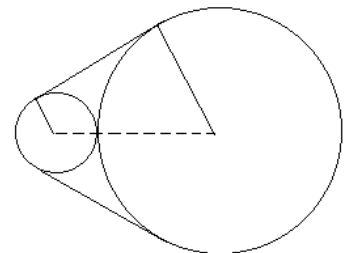


- b. Find the exact value of the ratio *area of major segment BC* : *area of ΔABC* . 5 marks

Q6 A dotted line connects the centres of two circular discs as shown in the diagram below. The radii of the discs are 1 unit and 4 units. A rubber loop is placed around the two discs to hold them together.

- a. Find the length of a straight section of the stretched rubber loop. 1 mark
- b. Find the length of the curved section of the stretched rubber loop touching the larger disc, correct to 2 decimal places.

4 marks

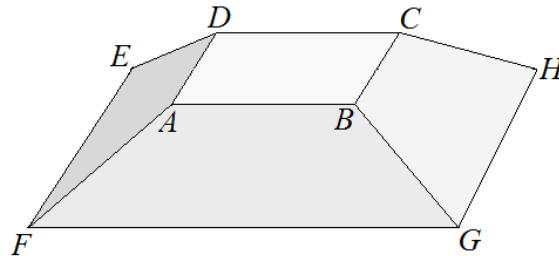


- c. Find the total length of the stretched rubber loop holding the discs together, correct to 2 decimal places.

3 marks



Q7 $ABCDEFGH$ is a regular frustum with a square top and a square base.
 The centre of the top square is directly above the centre of the bottom square.
 The corresponding sides of the squares are parallel, e.g. $AB \parallel FG$.
 The side lengths of the top and the bottom are 2 m and 4 m respectively. The height of the frustum is 1 m.



- a. Let the angle of depression of vertex H from vertex A be α . Find the exact value of $\tan \alpha$. 2 marks

- b. Let the angle of elevation of vertex A from vertex G be β . Find the exact value of $\sin \beta$. 2 marks

- c. Determine the acute angle (deg) between base square $EFGH$ and trapezium $CBGH$. 1 mark

- d. Determine the obtuse angle (deg) between trapezium $ABGF$ and trapezium $CBGH$. 3 marks