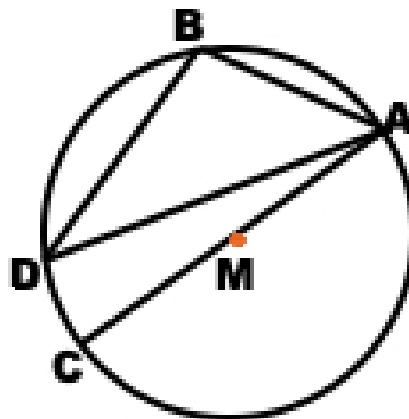


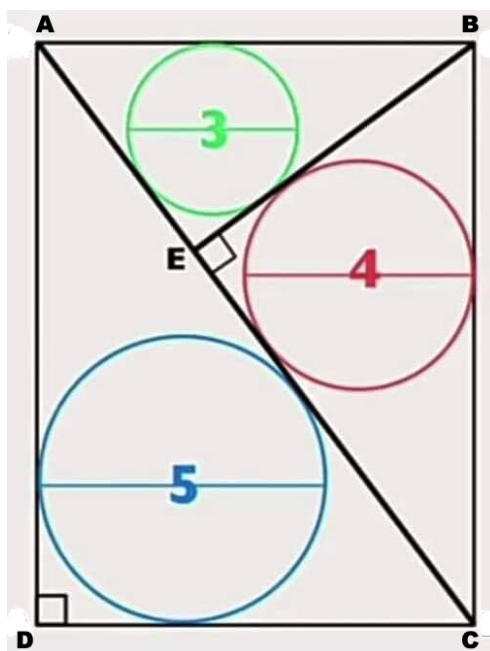
- Q1. In the following figure, AC is a diameter of a circle centered at M . If the measure of the angle $\angle DAB = 20^\circ$, find the measure of the angle $\angle ABD$.



- Q2. The rectangle $ABCD$ contains three tangent circles as shown in the following figure. The circle that touches the side AB has a diameter of 3cm , the circle that touches the side BC has a diameter of 4cm and the third circle that touches the sides AD and CD has a diameter of 5cm . If $BE \perp AC$, find the area of the rectangle $ABCD$.

HINT:

$$\tan(a + b) = \frac{\tan(a) + \tan(b)}{1 - \tan(a)\tan(b)}$$



Q3. Let $x \neq 1, y \neq 1, z \neq 1$ be real numbers. If $xyz = 1$, prove that

$$\frac{x^2}{(x-1)^2} + \frac{y^2}{(y-1)^2} + \frac{z^2}{(z-1)^2} \geq 1$$

Q4. There are 50 boxes in a factory. Their weights, w kg, are divided into 5 classes, as shown in the following table.

Classes	Weight (kg)	Number of boxes
A	$9.5 \leq w < 18.5$	7
B	$18.5 \leq w < 27.5$	12
C	$27.5 \leq w < 36.5$	13
D	$36.5 \leq w < 45.5$	10
E	$45.5 \leq w < 54.5$	8

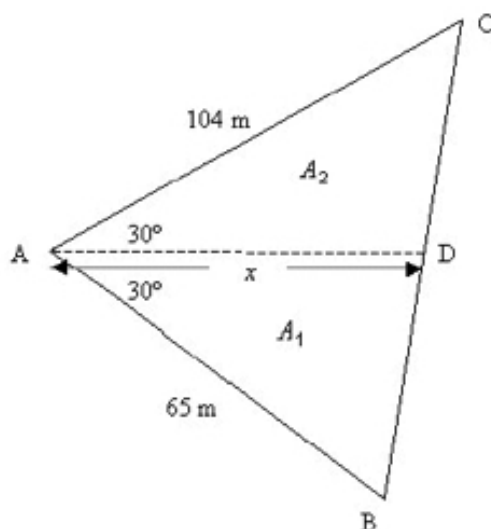
- (a) Show that the estimated mean weight of the boxes is 32 kg.
- (b) There are x boxes in the factory marked Fragile. They are all in class E. The estimated mean weight of all the other boxes in the factory is 30 kg. Calculate the value of x .
- (c) An additional y boxes, all with a weight in class D, are delivered to the factory. The total estimated mean weight of **ALL** of the boxes in the factory is less than 33 kg. Find the largest possible value of y .

Q5. A farmer owns a triangular field ABC . One side of the triangle, AC , is 104 m , a second side, AB , is 65 m and the angle between these two sides is 60° .

(a) Use the cosine rule to calculate the length of the third side of the field.

(b) Given that $\sin 60^\circ = \frac{\sqrt{3}}{2}$, find the area of the field in the form $p\sqrt{3}$ where p is an integer.

Let D be a point on BC such that AD bisects the 60° angle. The farmer divides the field into two parts A_1 and A_2 by constructing a straight fence AD of length x meters, as shown on the diagram below.



(c) (I) Show that the area of A_1 is given by $\frac{65x}{4}$.

(II) Find a similar expression for the area of A_2 .

(III) **Hence**, find the value of x in the form $q\sqrt{3}$, where q is an integer.

(d) (i) Explain why $\sin(\angle ADC) = \sin(\angle ADB)$.

(ii) Use the result of part (i) and the sine rule to show that $\frac{BD}{DC} = \frac{5}{8}$