



**Small Angle Approximations Exam Questions**

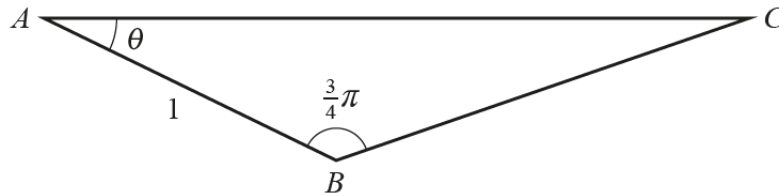
**Q1, (OCR H240/03, Sample Question Paper, Q4)**

Show that, for a small angle  $\theta$ , where  $\theta$  is in radians,

$$1 + \cos \theta - 3 \cos^2 \theta \approx -1 + \frac{5}{2} \theta^2$$

[4]

**Q2, (OCR H240/03, Practice Paper Set 1, Q3)**



The diagram shows triangle  $ABC$ , in which angle  $A = \theta$  radians, angle  $B = \frac{3}{4}\pi$  radians and  $AB = 1$  unit.

(i) Use the sine rule to show that  $AC = \frac{1}{\cos \theta - \sin \theta}$ . [3]

(ii) Given that  $\theta$  is a small angle, use the result in part (i) to show that

$$AC \approx 1 + p\theta + q\theta^2,$$

where  $p$  and  $q$  are constants to be determined.

[4]

**Q3, (OCR H240/02, Practice Paper Set 3, Q3)**

Use small angle approximations to estimate the solution of the equation  $\frac{\cos \frac{1}{2}\theta}{1 + \sin \theta} = 0.825$ , if  $\theta$  is small enough to neglect terms in  $\theta^3$  or above. [4]

**Q4, (Edexcel Practice Paper 5, Q2)**

(a) When  $\theta$  is small, show that the equation  $\frac{1 + \sin \theta + \tan 2\theta}{2 \cos 3\theta - 1}$  can be written as  $\frac{1}{1 - 3\theta}$ . (4 marks)

(b) Hence write down the value of  $\frac{1 + \sin \theta + \tan 2\theta}{2 \cos 3\theta - 1}$  when  $\theta$  is small.

(1 mark)

**Q5, (Edexcel A Level Maths, Jun 2018, Paper 1, Q1)**

Given that  $\theta$  is small and is measured in radians, use the small angle approximations to find an approximate value of

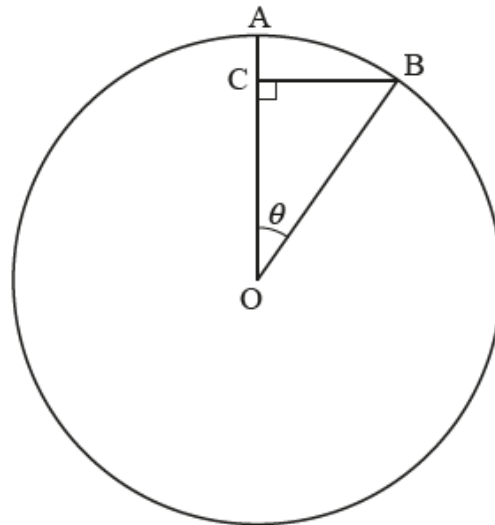
$$\frac{1 - \cos 4\theta}{2\theta \sin 3\theta}$$

(3)



**Q6, (OCR H640/03, Jun 2018, Q3)**

Fig. 3 shows a circle with centre O and radius 1 unit. Points A and B lie on the circle with angle  $AOB = \theta$  radians. C lies on AO, and BC is perpendicular to AO.



**Fig. 3**

Show that, when  $\theta$  is small,  $AC \approx \frac{1}{2}\theta^2$ .

[2]

**Q7, (Edexcel Mock Paper 2, Q1)**

(a) Given that  $\theta$  is small and in radians, show that the equation

$$\cos \theta - \sin\left(\frac{1}{2}\theta\right) + 2 \tan \theta = \frac{11}{10} \quad (\text{I})$$

can be written as

$$5\theta^2 - 15\theta + 1 \approx 0 \quad (3)$$

The solutions of the equation

$$5\theta^2 - 15\theta + 1 = 0$$

are 0.068 and 2.932, correct to 3 decimal places.

(b) Comment on the validity of each of these values as approximate solutions to equation (I).

(1)