AQA, Edexcel, OCR

A Level

A Level Mathematics

Understand and use the standard small angle approximations of sine, cosine and tangent

Name:

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Total Marks:

E2- Understand and use the standard small angle approximations of sine, cosine and tangent - Questions

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1) Sketch and derivate from it the geometric proof for the small angle approximations of sine, cosine and tangent. [4]

2) Give the small angle approximations for sine, cosine and tangent of: [6]

   i) 5^o

   ii) 10^o

3) Generate a table of the small angle approximations for sine, cosine and tangent of: [3]

$$0, \frac{\pi}{12}, \frac{\pi}{10}, \frac{\pi}{8}, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}, \pi$$

   i) Then add an additional column and complete the actual values. [3]

   ii) Plot the actual values against the approximations on a four quadrant axes ranging from -5 to 5 for Approximation (x-axis) and Actual (y-axis). [4]

   iii) Calculate the mean absolute percentage error for sine, cosine and tangent. [3]

4) A function machine takes two small angle approximations and multiplies them together. Jack puts in $\sin(9^o)$ and $\cos(9^o)$. Jill puts in $\sin(8^o)$ and $\tan(11^o)$. Show who ends up with the largest answer. Do not use a calculator. You may work using two decimal places. [4]

5) Approximate the value of $A = \frac{\pi}{12}$ with the formulas:

   i) $\cos(2A)$ [2]

   ii) $\sin(2A)$ [2]

   iii) $\tan(2A)$ [2]

   iv) $\sin(A)\cos(A)\tan(A)$ [2]

6) Your manager wants to save time but be accurate. You are allowed a 2% error in your approximations otherwise you must find the precise value. For $\sin(x)$:

   i) What integer angles, in degrees, would you not be allowed to approximate? Write your answer as an inequality. [2]

   ii) You are required to work out all the integer values of $\sin(x)$ from 1^o to 100^o Approximations take you 5 seconds, calculations take you 15 seconds, how long will this task take in total? [1]

   iii) If you were offered the swap to $\cos(x)$ or $\tan(x)$, would you? And why? [2]