IB MATHS AA HL · UNIT 3

Solving Trigonometric Equations: exam practice

10 questions · 40 marks · worked solutions and markschemes

Name _____ Date _____ Score / 40

- Answer every question before you look at the solutions. They start after the last question, with the marks for each line: M for method, A for accuracy, R for reasoning.
- Online, with more practice: ibmathrevision.com/hlaa/solving-trigonometric-equations-exam-practice

1. **3 marks · Paper 1 style · no calculator**

Solve $\tan 2x = \sqrt{3}$ for $0 \leq x \leq \pi$.

Find x. **[3]**

2. **3 marks · Paper 2 style · calculator**

Solve $3\tan^2 x = 1$ for $0 \leq x \leq 2\pi$.

Find x. **[3]**

3. **3 marks · Paper 2 style · calculator**

Solve $\sin\left(\frac{x}{2}\right) = 0.3$ for $0 \leq x \leq 4\pi$.

Find x. **[3]**

4. **3 marks · Paper 1 style · no calculator**

Solve $\sqrt{2}\cos\left(x+\frac{\pi}{4}\right)=1$ for $0\leq x\leq 2\pi$.

Find x. **[3]**

5. **4 marks · Paper 1 style · no calculator**

Solve $2\sin\left(2x-\frac{\pi}{3}\right)=1$ for $0\leq x\leq \pi$.

Find x. **[4]**

6. **4 marks · Paper 2 style · calculator**

Solve $4\sin^2 x-4\sin x-3=0$ for $0\leq x\leq 2\pi$.

Find x. **[4]**

7. **5 marks · Paper 1 style · no calculator**

Solve $2\cos^2 x = \sin x + 1$ for $0 \leq x \leq 2\pi$.

Find x. **[5]**

8. **5 marks · Paper 1 style · no calculator**

Solve $\sin 2x = \cos x$ for $0 \leq x \leq 2\pi$.

Find x. **[5]**

9. **5 marks · Paper 1 style · no calculator**

Solve $\cos 2x + 3\cos x + 2 = 0$ for $-\pi \leq x \leq \pi$.

Find x. **[5]**

10. **5 marks · Paper 1 style · no calculator**

Solve $\sin x + \sin 3x = 0$ for $0 < x < \pi$.

Find x. **[5]**

Answers and worked solutions

Question 1

3 marks

Answer: $x = \frac{\pi}{6}, x = \frac{2\pi}{3}$

$2x = \frac{\pi}{3}, \frac{4\pi}{3}$ $M1A1$

$x = \frac{\pi}{6}, \frac{2\pi}{3}$ A1

Question 2

3 marks

Answer:

$x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

$\tan x = \pm\frac{1}{\sqrt{3}}$ M1

$x = \frac{\pi}{6}, \frac{7\pi}{6}$ A1

$x = \frac{5\pi}{6}, \frac{11\pi}{6}$ A1

Question 3

3 marks

Answer: $x = 0.609, x = 5.67$

$\frac{x}{2} = 0.3047,\ \pi - 0.3047$ $M1$ A1

$x = 0.609, x = 5.67$ A1

Question 4

3 marks

Answer: $x = 0, \frac{3\pi}{2}, 2\pi$

$x + \frac{\pi}{4} = \frac{\pi}{4}, \frac{7\pi}{4}, \frac{9\pi}{4}$ $M1A1$

$x = 0, \frac{3\pi}{2}, 2\pi$ A1

Question 5

4 marks

Answer: $x = \frac{\pi}{4}, x = \frac{7\pi}{12}$

$2x - \frac{\pi}{3} = \frac{\pi}{6}, \frac{5\pi}{6}$ $M1A1$

$x = \frac{\pi}{4}, x = \frac{7\pi}{12}$ A1A1

Question 6

4 marks

Answer: $x = \frac{7\pi}{6}, x = \frac{11\pi}{6}$

$(2\sin x + 1)(2\sin x - 3) = 0$ $M1A1$

$\sin x = -\frac{1}{2}$ ($\sin x = \frac{3}{2}$ impossible) R1

$x = \frac{7\pi}{6}, \frac{11\pi}{6}$ A1

Question 7

5 marks

Answer: $x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$

$2(1 - \sin^2 x) = \sin x + 1$ M1

$(2\sin x - 1)(\sin x + 1) = 0$ A1

$x = \frac{\pi}{6}, \frac{5\pi}{6}$ A1A1

$x = \frac{3\pi}{2}$ A1

Question 8

5 marks

Answer:

$x = \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \frac{3\pi}{2}$

$2\sin x \cos x - \cos x = 0$ M1

$\cos x(2\sin x - 1) = 0$ A1

$x = \frac{\pi}{2}, \frac{3\pi}{2}$ A1

$x = \frac{\pi}{6}, \frac{5\pi}{6}$ A1A1

Question 9

5 marks

Answer: $x = \pm\frac{2\pi}{3}, x = \pm\pi$

$2\cos^2 x - 1 + 3\cos x + 2 = 0$ M1

$(2\cos x + 1)(\cos x + 1) = 0$ A1

$x = \pm\frac{2\pi}{3}$ A1A1

$x = \pm\pi$ A1

Question 10

5 marks

Answer: $x = \frac{\pi}{2}$

$2\sin 2x \cos x = 0$ $M1A1$

$\sin 2x = 0$: $x = \frac{\pi}{2}$ A1

$\cos x = 0$: $x = \frac{\pi}{2}$ A1

only solution $x = \frac{\pi}{2}$ A1

Every solution is also on ibmathrevision.com/hlaa/solving-trigonometric-equations-exam-practice
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