Worked Solutions for ENGAA Papers by Topic

Section 1

Topic: Trigonometry

Section 1 Topic	Number of Questions 2016 - 2020
Algebra	34
Calculus	16
Coordinate geometry	11
Electricity	18
Energy	8
Exponentials and logarithms	9
Forces and equilibrium	7
Geometry	40
Kinematics	15
Materials	2
Matter & thermal physics	5
Mechanics	55
Number	11
Probability	3
Radioactivity	14
Ratio and proportion	7
Sequences and series	8
Trigonometry	6
Waves	13

ENGAA S1 2019 - Question 27

27 It is given that

$$7\cos x + \tan x \sin x = 5$$

where $0° < x < 90°$

What are the possible values of $\tan x$?

A $\frac{1}{2}$ or $\frac{1}{3}$

B $\frac{1}{\sqrt{3}}$ or $\frac{1}{2\sqrt{2}}$

C $\frac{\sqrt{3}}{2}$ or $\frac{2\sqrt{2}}{3}$

D $\sqrt{3}$ or $2\sqrt{2}$

E 3 or 2

ENGAA S1 2019 - Question 27 - Worked Solution

$$7 + tan^2x = 5secx$$
$$7 + sec^2 - 1 = 5secx$$
$$\lambda^2 - 5\lambda + 6 = 0 \qquad (\lambda = secx)$$
$$\lambda = \frac{5}{2} \pm \frac{1}{2}\sqrt{25 - 24}$$
$$secx = 2\,, 3$$
$$Using\ tan^2x + 1 = sec^2x$$
$$sec = 2$$
$$tanx = \sqrt{4 - 1}$$
$$tanx = \sqrt{3}$$
$$sec = 3$$
$$tanx = \sqrt{9 - 1}$$
$$tanx = 2\sqrt{2}$$

Answer is D

ENGAA Specimen S1 - Question 25

25 Which one of the following numbers is largest in value?

(All angles are given in radians.)

A $\tan\left(\frac{3\pi}{4}\right)$

B $\log_{10} 100$

C $\sin^{10}\left(\frac{\pi}{2}\right)$

D $\log_2 10$

E $\left(\sqrt{2}-1\right)^{10}$

ENGAA Specimen S1 - Question 25 - Worked Solution

$$tan\ tan\ \frac{3\pi}{4} = -1$$

$$100 = 2$$

$$sin^{10}\left(\frac{\pi}{2}\right) = 1$$

$$10 > 3\ as\ we\ know\ that\ (8) = 3$$

$$\left(\sqrt{2}-1\right)^{10} < 1\ since\ we\ know\ that\ \left(0 < \left(\sqrt{2}-1\right) < 1\right)$$

Answer is D

ENGAA Specimen S1 - Question 39

39 The angle x is measured in radians and is such that $0 \le x \le \pi$.

The total length of any intervals for which $-1 \le \tan x \le 1$ and $\sin 2x \ge 0.5$ is

A $\frac{\pi}{12}$

B $\frac{\pi}{6}$

C $\frac{\pi}{4}$

D $\frac{\pi}{3}$

E $\frac{5\pi}{12}$

F $\frac{\pi}{2}$

G $\frac{5\pi}{6}$

ENGAA Specimen S1 - Question 39 - Worked Solution

$$-1 \le tan\ tan\ x\ \le 1\ is\ satisfied\ when\ 0 \le x \le \frac{\pi}{4}\ and\ \frac{3\pi}{4} \le x \le \pi$$

$$sin\ sin\ 2x\ \ge 0.5\ is\ satisfied\ when\ \frac{\pi}{6} \le 2 \le \frac{5\pi}{6}\ so\ \frac{\pi}{12} \le x \le \frac{5\pi}{12}$$

$$both\ are\ satisfied\ for\ \frac{\pi}{12} \le x \le \frac{\pi}{4}$$

$$the\ length\ of\ the\ interval = \frac{\pi}{6}$$

Answer is B

ENGAA S1 2018 - Question 31

31 How many solutions of the equation $2\sin^3\theta = \sin\theta$ lie in the interval $-\frac{\pi}{2} \leq \theta \leq \pi$?

A 2

B 3

C 4

D 5

E 6

F 7

ENGAA S1 2018 - Question 31 - Worked Solution

$$sin\ sin\ 6\left[2sin^2\theta - 1\right] = 0$$

$$sin\ sin\ \theta = 0$$

$$\theta = 0, \pi$$

$$sin\ sin\ \theta = \pm\frac{1}{\sqrt{2}}$$

$$\theta = \frac{\pi}{4}, \left(-\pi + \frac{\pi}{4}\right), -\frac{\pi}{4}, \left(-\pi + \frac{\pi}{4}\right)$$

$$= \frac{4}{\pi}, \frac{3\pi}{4}, -\frac{4}{\pi}, -\frac{3\pi}{4}$$

5 Solutions

Answer is D.

ENGAA S1 2017 - Question 31

31 k is the smallest positive value of x which is a solution to **both** the equations $2\sin x + 1 = 0$ **and** $2\cos 2x = 1$

How many values of x in the range $0 \le x \le k$ are solutions to at least one of these equations?

A 0

B 2

C 3

D 4

E 8

ENGAA S1 2017 - Question 31 - Worked Solution

$$2\ sin\ sin\ x\ + 1 = 0$$

$$sin\ sin\ x\ = -\frac{1}{2}$$

$$x = 210°, 330°, \ldots$$

$$2\ cos\ cos\ (2x) = 1$$

$$cos\ cos\ (2x) = \frac{1}{2}$$

$$2x = 60°, 300°, 420°, 660°$$

$$x = 30°, 150°, 210°, 330°, \ldots$$

So for a solution to exist:

$$k = 210°$$

Number of solutions : 3 (210 , 30 , 50 each solve at least one)

Answer is C

ENGAA S1 2016 - Question 37

37 Given that $7\cos\theta - 3\tan\theta\sin\theta = 1$, which one of the following is true?

A $\cos\theta = -\frac{3}{5}$ or $-\frac{1}{2}$

B $\cos\theta = -\frac{3}{5}$ or $\frac{1}{2}$

C $\cos\theta = \frac{3}{5}$ or $\frac{1}{2}$

D $\cos\theta = \frac{3}{5}$ or $-\frac{1}{2}$

ENGAA S1 2016 - Question 37 - Worked Solution

$$7\,cos\,cos\,\theta - 3\,tan\,tan\,\theta\,\,sin\,sin\,\theta = 1$$

$$7\,cos\,cos\,\theta - 3\frac{sin\,sin\,\theta}{cos\,cos\,\theta}\,sin\,sin\,\theta = 1$$

$$7cos^2\theta - 3sin^2\theta = cos\,cos\,\theta$$

$$7cos^2\theta - 3(1 - cos^2\theta) = cos\,cos\,\theta$$

$$Let\,u = cos\,cos\,\theta$$

$$7u^2 - 3 + 3u^2 = u$$

$$10u^2 - u - 3 = 0$$

$$u = \frac{1 \pm \sqrt{1^2 - 4(10)(-3)}}{20}$$

$$u = \frac{1 \pm \sqrt{121}}{20}$$

$$u = \frac{1 \pm 11}{20}$$

$$u = \frac{12}{20}\;,\quad u = \frac{10}{20}$$

$$cos\,cos\,\theta = \frac{3}{5}\;,\quad cos\,cos\,\theta = -\frac{1}{2}$$

Answer is D