Theta Seat - Question 0

A = $3^3 = 27$. Therefore **A** = 7

Alpha Seat – Question 0

B = $\cos\left(\frac{7\pi}{4}\right) = \frac{\sqrt{2}}{2}$

Mu Seat – Question 0

C = $\frac{d}{dx}(x^2) = 2x \to 2\left(\frac{\sqrt{2}}{2}\right) = \sqrt{2}$

Theta Seat – Question 1

A = $\left(\frac{x-1}{3}\right)^2 + \left(\frac{y+3}{2}\right)^2 = 1$. Therefore the area is 6π

Alpha Seat – Question 1

B = $\tan 2x - \sqrt{3} = 0$ over the interval $[0, \pi)$ yields 2 solutions, the largest of which is $\frac{2\pi}{3}$

Mu Seat – Question 1

C = $\int_0^{\frac{2\pi}{3}} [x]\, dx = 0 + 1 + \left(\frac{2\pi}{3} - 2\right)2 = \frac{4\pi}{3} - 3$

Theta Seat – Question 2

A = $120 = 2^3 \cdot 3 \cdot 5 = (1+2+4+8)(1+3)(1+5) = 360$

Alpha Seat – Question 2

B = speed = $\left(\frac{10\cdot 2\pi}{60}\right) = \frac{\pi}{3}$

Mu Seat – Question 2

C = $\tan\theta = \frac{5}{x} \to \sec^2\theta \frac{d\theta}{dt} = -\frac{5}{x^2}\frac{dx}{dt} \to \frac{d\theta}{dt} = -\frac{3}{5} \cdot \frac{1}{4} \cdot -600 = 90\, \frac{rads}{hour}$

Theta Seat – Question 3

A = $(-1)^{2+2}\begin{vmatrix} 1 & 6 \\ 0 & -3 \end{vmatrix} = -3$

Alpha Seat – Question 3

B = $\cos x = \frac{5}{13} \rightarrow \sin x = -\frac{12}{13} \rightarrow \sin 2x = 2\left(\frac{5}{13}\right)\left(-\frac{12}{13}\right) = -\frac{120}{169}$

Mu Seat – Question 3

C = $\frac{1}{-B} = \frac{169}{120} = 1.xxx \rightarrow \pi\int_{-1}^{1}(1-x^2)^2\,dx = \frac{16\pi}{15}$

Mu Seat – Question 4

A = $10(m+n) = mn \rightarrow (m-10)(n-10) = 100$. 100 has 18 divisors (positive and negative). However, we do not count when $m = n = 0$, therefore there are 17 solutions.

Theta Seat – Question 4

B = $(x-3)^4$ so the coefficient of the second term is $\binom{4}{1} \cdot 1 \cdot (-3) = -12$

Alpha Seat – Question 4

C = $A = 7,\ B = -6\sqrt{3},\ C = 13 \rightarrow \cot 2\theta = \frac{7-13}{-6\sqrt{3}} = \frac{\sqrt{3}}{3}$

Mu Seat – Question 5

A = $x - (x^2 - x)dx = \frac{4}{3} \rightarrow x - (x^2 - x)dx = \frac{2}{3} \rightarrow k^2 - \frac{1}{3}k^3 = \frac{2}{3} \rightarrow k^3 - 3k^2 + 2 = 0 \rightarrow k = 1$

Theta Seat – Question 5

B = Sum of squares is equal to $b^2 - 2ac = 27 - 26 = 1$.

Alpha Seat – Question 5

C = the vectors you will use are $\begin{pmatrix} 1 \\ -2 \\ 1 \end{pmatrix}$ and $\begin{pmatrix} 2 \\ 3 \\ -2 \end{pmatrix}$. Therefore $\cos\theta = \frac{|-6|}{\sqrt{6}\sqrt{17}} = \frac{\sqrt{102}}{17}$

Mu Seat – Question 6

A =

$$M_y = \int_0^3 \left(\frac{3x - x^2}{2}\right)^2 dx = \frac{x^5}{10} - \frac{3x^4}{4} + \frac{3x^3}{2}\Bigg|_0^3 = \frac{81}{20}$$

$$Area = \int_0^3 (3x - x^2)\, dx = \frac{3x^2}{2} - \frac{x^3}{3}\Bigg|_0^3 = \frac{9}{2}$$

$$ordinate = \frac{\frac{81}{20}}{\frac{9}{2}} = \frac{9}{10}$$

Theta Seat – Question 6

B = $\frac{9}{10}\left(\frac{1}{1-\frac{2}{2+\sqrt{3}}}\right) = \frac{9}{10}\left(\frac{2+\sqrt{3}}{\sqrt{3}}\right) = \frac{9}{10} + \frac{3\sqrt{3}}{5} \rightarrow \frac{9}{10} - \frac{3}{5} = \frac{3}{10}$

Alpha Seat – Question 6

C =by using the formula $r = \frac{abc}{4(area)}$ we get $r = \frac{(\sqrt{20})(\sqrt{52})(\sqrt{40})}{4 \cdot 14} = \frac{5\sqrt{26}}{7}$

Alpha Seat – Question 7

A = $\frac{\sin 67x + \sin x}{\cos 67x + \cos x} = \frac{\sin(34x+33x)+\sin(34x-33x)}{\sin(34x+33x)+\cos(34x-33x)} = \frac{2\sin 34x \cos 33x}{2\cos 34x \cos 33x} = \tan(34x)$, period is $\frac{\pi}{34}$.

Mu Seat – Question 7

B = $\int_0^{34\pi} |\cos(2t)|\, dt = 68$

Theta Seat – Question 7

C = If $k = 1{\sim}3 \rightarrow [\sqrt{k}] = 1,$ sum $= 3$

If $k = 4{\sim}8 \rightarrow [\sqrt{k}] = 2$, sum $= 3 + 2 \cdot 5 = 13$

If $k = 9{\sim}15 \rightarrow [\sqrt{k}] = 3$, sum $= 13 + 3 \cdot 7 = 34$

If $k = 16 \rightarrow 24 \rightarrow [\sqrt{k}] = 4,$ sum $= 34 + 4 \cdot 9 = 70$

So 24 is the smallest integer.

Alpha Seat – Question 8

A = using trig identities and algebra, we can rewrite the expression as a pair of factors $(2\sin\theta - 1)\left(\sin 2\theta + \frac{\sqrt{3}}{2}\right) = 0$. Solving yields 5 unique solutions, namely $\frac{\pi}{6}, \frac{2\pi}{3}, \frac{5\pi}{6}, \frac{5\pi}{3}, \frac{11\pi}{6}$.

Mu Seat – Question 8

B = $f(x) = 5\sin x + 6\cos x$ and it's maximum value is $\sqrt{5^2 + 6^2} = \sqrt{61}$

Theta Seat – Question 8

C = the number of diagonals is $\frac{n(n-3)}{2}$. $10B = 10\sqrt{61} \sim 78$.

$\frac{n(n-3)}{2} > 78 \rightarrow n(n-3) > 156$. Solving this gives $n = 15 \rightarrow 180 > 156$. Note that if $n = 14 \rightarrow \frac{n(n-3)}{2} = 76$ and $100 \cdot 61 > 76^2$. For a regular 15-gon, each interior angle measures $180 - \frac{360}{15} = 156°$

Alpha Seat – Question 9

A = Using synthetic division we find that the largest zero is 4.

Mu Seat – Question 9

B = $(3x^4 + 8x^3 - 48x^2 + k + 4)' = 12x^3 + 24x^2 - 96x = 12x(x+4)(x-2)$. Plugging in the relative minimum $x = -2, 4$ the minimum is -512 at $x = -4$. $k + 4 = 512 \rightarrow k = 508$

Theta Seat – Question 9

C = $k = 13 \rightarrow x + \frac{1}{x} = 13$. $r^3 + \frac{1}{r^3} = \left(r + \frac{1}{r}\right)\left(\left(r + \frac{1}{r}\right)^2 - 3\right) = 13 * 166 = 2158$