ROUND ONE

1. Find the slope of the line which is perpendicular to the line through (-2, 1) and (3, 5).

Give your answer as a fraction in its simplest form

2. $\int (3x-2)dx =$

ROUND TWO

1. Given that $f(x) = 3x - x^2$, express $\lim_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$ in the form $a + bx,$ where $a, b \in \mathbf{Z}$.

2. Find the equation of the tangent to the circle $x^2 + y^2 = 13$ at the point (-2, 3).

Answer in the form $ax + by + c = 0,$ where $a, b, c \in \mathbf{Z}$.

ROUND THREE

1. In how many ways can 5 students be seated in a row if 2 particular students never sit together? Answer as a single whole number.

2. C is an angle in the fourth quadrant such that $\cos C = \frac{5}{13}$.

Express $\tan C$ in the form $\frac{a}{b}$, where $a, b \in \mathbf{Z}$.

ROUND FOUR

1. Solve for x, given that the logarithms are real numbers,

$$\log_3(x+4) + \log_3(6-x) = 2.$$

2. Express $\frac{1}{x+1} + \frac{3}{x-1} + \frac{2x}{1-x^2}$ in the form $\frac{a}{x+b}$, where $a, b \in \mathbf{Z}$.

ROUND FIVE

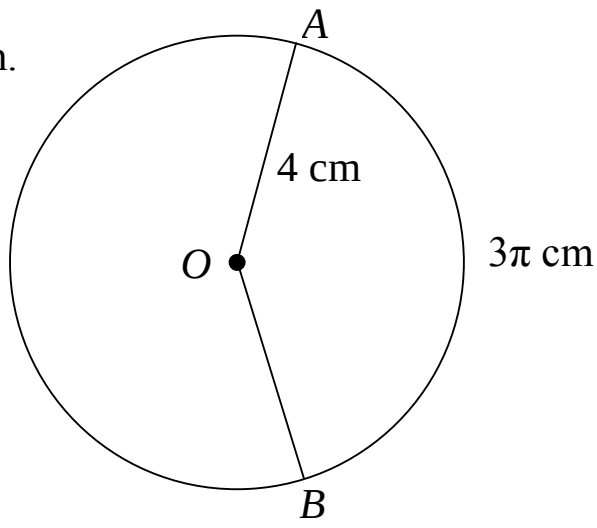
1. What is the probability that two cards randomly selected from a standard pack of 52 cards are neither of the same value nor of the same suit?

2. Write $6\sin 8x\cos 8x$ in the form $a\sin bx,$ where $a,b \in N$.

ROUND SIX

1 The circle has a radius of 4 cm.
The length of the arc AB is 3π cm.

Find the measure of
the angle AOB in radians.



2. Express $\sum_{k=3}^{5} \log k$ in the form $\log n,$ where $n \in N$.

ROUND SEVEN

1. Express $\frac{(n-2)!}{(n-1)!}$ in its simplest form.

2. Let $z = 2 + i$ and $w = 1 - i$. Express $z\overline{w}$ in the form $x + yi$.

3. Find the equation of the tangent to the curve $y = \cos 2x$ at the point whose *x*-coordinate is $\frac{\pi}{6}$.

4. Let α and β be the roots of $x^2 - 3x + 1 = 0$. Find the value of $\alpha + \frac{1}{\alpha}$.

ROUND EIGHT

1. The line $y-2=0$ is a tangent to the circle with equation $x^2+y^2+8x-2y+k=0$. Find the value of *k*.

2. $A=\begin{pmatrix}2 & 0\\ 1 & 1\end{pmatrix}$ and $B=\begin{pmatrix}0 & 1\\ 1 & 4\end{pmatrix}$. Evaluate $(BA)^{-1}$.

3. Given that $y=\log_e(\cos x)$, evaluate $\frac{dy}{dx}$ at $x=\frac{\pi}{4}$.

4. Find the values of *k* for which $y=2x+1$ does **not** intersect $y=2x^2+kx+9$.

	ROUND 1	**ROUND 2**	**ROUND 3**	**ROUND 4**	**ROUND 5**	**ROUND 6**	**ROUND 7**	**ROUND 8**	**TIEBREAK**
Q.1	$Slope = \frac{-5}{4}$ (*any* valid form)	3 - 2x	72	(-3,5)	$\frac{12}{17}$	$\frac{3\pi}{4}$	$\frac{1}{n-1}$	16	84
Q.2	$\frac{3x^2}{2} - 2x + C$	2x - 3y +13 = 0	$\frac{-12}{5}$	$\frac{2}{x-1}$	3sin16x	$\frac{3\pi}{4}$	1 + 3i	$\begin{pmatrix} -2 & \frac{1}{2} \\ 3 & -\frac{1}{2} \end{pmatrix}$	$(-\frac{1}{2}, \pm\frac{1}{2})$
Q.3							$y - \frac{1}{2} = -\sqrt{3}(x - \frac{\pi}{6})$	- 1	$\frac{115}{6}$
Q.4							3	-6<k <10	6