

BABHTA 1 - ROUND 1

- 1) Express $\frac{-5}{i-\sqrt{3}}$ in the form $r(\cos \theta + i \sin \theta)$
- 2) Find the coordinates of the point P which divides the line segment joining A(-9, 14) and B(5.4, -5.2) internally in the ratio 5 : 1.

BABHTA 2 - ROUND 2

- 1) If α and β are roots of the equation $2x^2 + 5x + 1 = 0$ form an equation whose roots are $\frac{\alpha}{\beta}$ and $\frac{\beta}{\alpha}$.
Put answer in the form $ax^2 + bx + c = 0$,
where **a, b, c** $\in \mathbb{Z}$
- 2) If a committee of 5 is to be chosen from 9 people at random, what is the probability that a particular person will be on the committee?
Leave your answer in the form $\frac{a}{b}$,
where **a** and **b** $\in \mathbb{Z}$

BABHTA 3 - ROUND 3

- 1) The point $(3, a)$ is a solution of the equations

$$x + 4y + 5 = 0$$

$$bx^2 + 9xy + 25 = 4y^2$$

Find the value of a and the value of b ,
where a and $b \in \mathbb{Z}$

- 2) The points $A(1,1)$, $B(0,0)$ and $C(2,-1)$ form a triangle.

Find the measure of the angle $\angle ABC$ to the nearest degree.

BABHTA 4 - ROUND 4

- 1) In how many ways can a careless secretary place four letters in four envelopes so that nobody gets the right letter?
- 2) Solve the equation $\tan(x) + \tan(2x) = 0$,
where $0 \leq x \leq 2\pi$.
Answers in terms of π .

BABHTA 5 - ROUND 5

- 1) Find the coordinates of the foot of the perpendicular from the point $(2, -6)$ to the line $3y - x + 2 = 0$
- 2) The probability that John will beat Joe in a game of chess is $\frac{2}{3}$. In a series of 6 games, what is the probability that John will win 4 or more games?
Answer in form $\frac{a}{b}$ where \mathbf{a} and $\mathbf{b} \in \mathbf{Z}$

BABHTA 6 - ROUND 6

1) Find $\int \frac{\cos^5(x)}{\sin^2(x)} dx$

2) Find the equations of the tangents from $(-1, 5)$ to the circle $x^2 + y^2 - 4x + 2y - 31 = 0$

Answers in the form $ax+by+c=0$,
where **a**, **b** and **c** $\in \mathbb{Z}$

BABHTA 7 - ROUND 7

- 1) In a private sweep, 100 tickets are sold. A man buys one ticket. A prize is awarded on each draw of a ticket. Assuming replacement of a ticket after each draw, find the least number of prizes which must be awarded so that the probability of the man winning at least one prize is at least $\frac{1}{4}$.
- 2) Find the numerical value of the greatest term of the expansion $(1+2x)^9$ when $x = \frac{1}{3}$. Leave your answer as a fraction.
- 3) Find θ , in radians, correct to 3 significant figures, the acute angle between the lines

$$3x + 2y = 5 \text{ and } 2x - y = 6.$$

- 4) Find the value of $\frac{\cos(\frac{\pi}{8}) + i\sin(\frac{\pi}{8})}{\cos(\frac{3\pi}{8}) - i\sin(\frac{3\pi}{8})}$

BABHTA 8 - ROUND 8

- 1) Differentiate $\cos(x)$, when x is in degrees.

- 2) Find the value of $\sin^2(x) + \sin^2(60^\circ - x) + \sin^2(60^\circ + x)$
in the form $\frac{a}{b}$, where a and $b \in \mathbb{Z}$.

- 3) Julie devises a game in which a player can choose to pay at random from a 1 cent coin, a 5 cent coin, a 20 cent coin and a 50 cent coin. How much should she have charged and still hope to break as even as possible?

- 4) If two litres of a 20% acid solution are mixed with 8 litres of a 50% acid solution, what is the percentage concentration of the resulting solution?

TIEBREAK

- 1) Find the value of x if $x - 2(1 - 3x) = 6 + 3(4 - x)$
- 2) Find the slope of the line passing through A(-3,2) and B(4,-1).
Answer as a fraction.
- 3) How many pairs of parallel faces on a regular cube?
- 4) What is the maximum number of points of intersection of four distinct straight lines?
- 5) Find the values of x if $x^2 = 2x + 1$. Answer in surd form.
- 6) Find the range of values of x for which $x^2 \geq 4x + 5$, $x \in \mathbb{R}$
- 7) Solve the following equations for x and y:

$$2y^2 - 3x = 0$$

$$4y - x = 6$$

Write your answer in coordinate form.

- 8) Find the value of $\text{Cos}(15^\circ)$ in simplest surd form.
- 9) Find the length of the tangent from A(8, -3) to the circle $x^2 + y^2 - 2x + 8y - 23 = 0$.
Answer in surd form.
- 10) Using only 5c , 10c and 20c coins, in how many ways can you make up 35 cents?
- 11) One bag contains 4 white and 4 black balls, a second bag contains 3 white and 6 black balls, and a third contains 1 white and 5 black balls.
If one ball is drawn from each bag find the probability that all are white.
- 12) Using the letters of the word EQUATIONS how many 5 letter “words” contain all the consonants?
- 13) Find the value of $(\sqrt{3} - i)^{10}$ in the form $x + iy$.
- 14) Find the number of digits that are required to number the pages of a book from page 1 to page 250.

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Answer Key

Round 1	Q1	$\frac{5}{2}(\text{Cos}(\frac{\pi}{6}) + i\text{Sin}(\frac{\pi}{6}))$ or $2.5(\text{Cos}(30) + i\text{Sin}(30))$
	Q2	P(3, -2)
Round 2	Q1	$2x^2 - 21x + 2 = 0$
	Q2	$\frac{5}{9}$
Round 3	Q1	a = -2 , b = 5
	Q2	72^0
Round 4	Q1	9
	Q2	$0, \pi, 2\pi, \frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$
Round 5	Q1	$(\frac{1}{5}, -\frac{3}{5})$ or (0.2, -0.6)
	Q2	$\frac{496}{729}$
Round 6	Q1	$-\frac{1}{\text{Sin}(x)} - 2\text{Sin}(x) + \frac{\text{Sin}^3(x)}{3} + C$
	Q2	y-5=0 and 4x - 3y + 19 = 0

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Round 7	Q1 29
	Q2 $\frac{224}{9}$
	Q3 1.05 radians
	Q4 <i>i</i>
Round 8	Q1 $-\frac{\pi}{180} \sin\left(\frac{\pi}{180}\right)$
	Q2 $\frac{3}{2}$
	Q3 19 cent
	Q4 44%

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Tiebreak answers:

1) $x = 2$	
2) $-\frac{3}{7}$	
3) 3	
4) 6	
5) $1 \pm \sqrt{2}$	
6) $x \leq -1$ or $x \geq 5$	
7) (6,3)	
8) $\frac{\sqrt{6} + \sqrt{2}}{4}$ OR $\frac{\sqrt{3} + 1}{2\sqrt{2}}$	
9) $\sqrt{10}$	
10) 6	
11) $\frac{1}{36}$	
12) 600	
13) $512 + 512\sqrt{3}i$	
14) 642	