Round 1 Babtha 1

Question 1

A drawer contains 5 red markers and n blue markers. One marker is drawn at random and not replaced. A second marker is then selected at random. If the probability that both markers are blue is $\frac{1}{6}$, find the total number of markers in the box at the start.

Question 2

Determine the real numbers p and q such that $(p + iq)^2 = 5 + 12i$, where $i = \sqrt{-1}$.

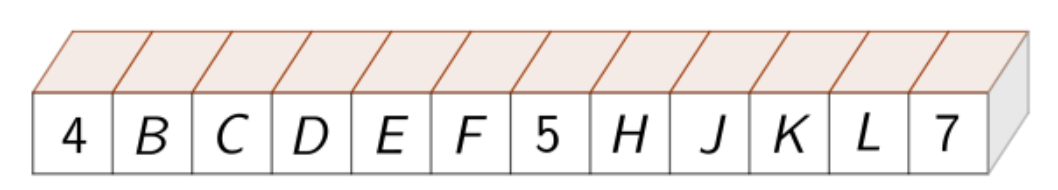
Round 2 Babtha 2

Question 1

A fair, six-sided die is thrown seven times. What is the probability that a '6' occurs on exactly 2 of the 7 throws? Give your answer correct to 3 decimal places.

Question 2

Twelve blocks are arranged as illustrated in the diagram.



Each letter shown on the front of a block represents a number. The sum of the numbers on any four consecutive blocks is 25.

Determine the value of B + F + K.

Round 3 Babtha 3

Question 1

The positive integers can be arranged as follows.

Row 1	1					
Row 2	2	3				
Row 3	4	5	6			
Row 4	7	8	9	10		
Row 5	11	12	13	14	15	
Row 6	16	17	18	19	20	21
⋮	⋮	⋮	⋮	⋮	⋮	⋮

More rows and columns continue to list the positive integers in order, with each new row containing one more integer than the previous row. How many integers, less than 2022, are in the column that contains the number 2022?

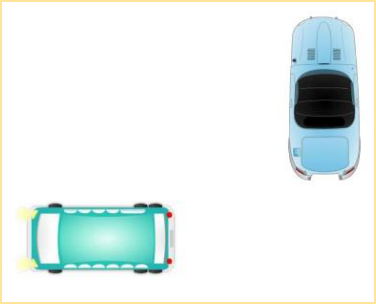
Question 2

XYZ is a triangle where $|XY| = 8$ cm and $|YZ| = 6$ cm. Given that the area of triangle XYZ is $12cm^2$, find the two possible values of $|\angle XYZ|$.

Round 4 Babtha 4

Question 1

At 7:00 a.m., Sahil drives north at 48 km/h. At the same time from the same intersection, Brenda drives west at 64 km/h. At what time will they be 260 km apart?



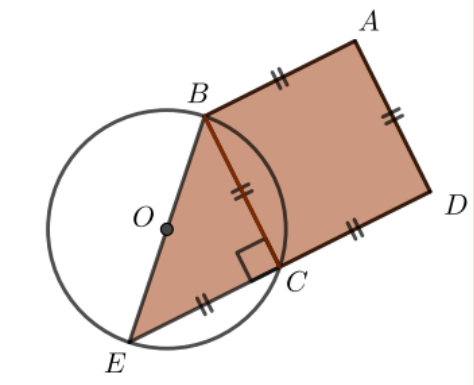
Question 2

Georgina enters a 12 km race. She wants to finish the race in one hour and twenty minutes. She starts off jogging at a speed of 7 km/h. After 30 minutes, she realizes that she needs to increase her speed to finish the race in her desired time. For the remaining time, what speed must she run at to finish the race in exactly one hour and twenty minutes?

Round 5 Babtha 5

Question 1

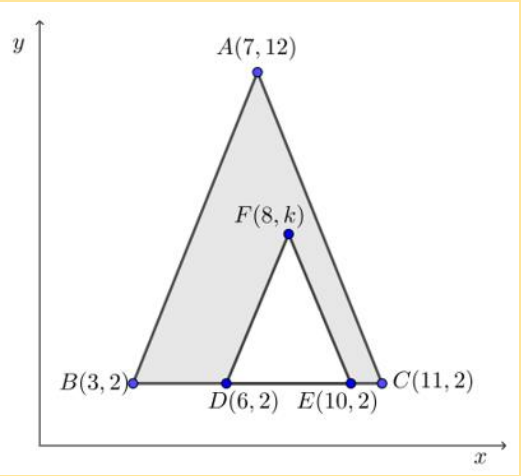
Quadrilateral ABED is made up of square ABCD and right isosceles triangle BCE. BE is a diameter of the circle with centre O. Point C is also on the circle.



If the area of ABED is $24cm^2$, what is the length of BE, correct to 1 decimal place?

Question 2

Points $A(7,12)$, $B(3,2)$, $C(11,2)$, $D(6,2)$ and $E(10,2)$ are placed on the Cartesian plane, as shown. The point F is placed inside ΔABC so that the area of the shaded region is $32\ units^2$. If the point F is $(8,k)$, find the value of k.

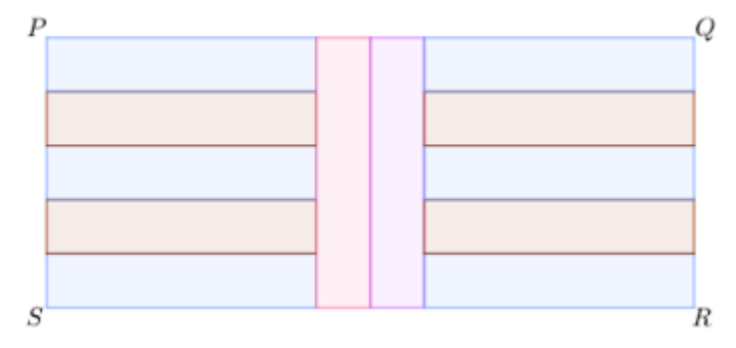


Round 6 Babtha 6

Question 1

Twelve identical smaller rectangles are arranged as shown in the diagram to form a large rectangle $PQRS$.

If the area of rectangle $PQRS$ is $540\ cm^2$, determine the integer dimensions of the smaller rectangles.



Question 2

By solving the following simultaneous equations, determine the value of $x + y + z$

$$3x - y + 3z = 1$$

$$x + 2y - 2z = -1$$

$$4x - y + 5z = 4.$$

Round 7 Babtha 7

Question 1

The first three terms of a geometric sequence are $2x - 4$, $x + 1$, and $x - 3$. Find the two possible values of x.

Question 2

Bill and Ben win some money in their local lottery. They share the money in the ratio $3: 4$. Ben decides to give €40 to his sister. The amount that Bill and Ben have now is in the ratio $6: 7$. Calculate the total amount of money won by Bill and Ben.

Question 3

The area of a sector of a circle is 27 cm^2. The length of the radius of the circle is 6 cm. Find, in radians, the measure of the angle in the sector.

Question 4

By writing $cos2x$ in terms of $sinx$, or otherwise, find all the solutions of the equation $cos2x - sinx = 1$, in the domain $0° \leq x \leq 360°$.

Round 8 Babtha 8

Question 1

The junior and senior students at Mathville High School are going to present an exciting musical entitled, "Math, What is it Good For?". A large group of students came out to an information meeting. After a brief introduction to the musical, 15 senior students decided that it was not for them, and they left. At that point, twice as many junior students as senior students remained. Later in the meeting, after the 15 senior students had left, $\frac{3}{4}$ of the junior students and $\frac{1}{3}$ of the remaining senior students also left. This left 8 more senior students than junior students. All the remaining students stuck it out and went on to produce an amazing show. How many students remained to perform in the school musical, "Math, What is it Good For?"

Question 2

α and β are real numbers such that $\alpha + \beta = -7$ and $\alpha\beta = 11$.

Find the value of $\alpha^2 + \beta^2$.

Question 3

Solve $\log_6(x+5) = 2 - \log_6 x$, for $x > 0$.

Question 4

Given $y = 2x - sin2x$, $\frac{dy}{dx}$ can be written in the form $ksin^2x$, where $k \in Z$. Find the value of k.

Tiebreak Questions

1	What is the sum of the positive integers from 1 to 1,000,000?
2	Find the acute angle between the lines $x - 2y + 1 = 0$ and $y = 3x - 4$. Answer in degrees (no unit needed).
3	Nine cards are numbered from 1 to 9. Three cards are drawn at random from the nine cards. The probability that the card numbered 8 is not drawn is written in its simplest form as $\frac{a}{b}$. Find the value of $a + b$.
4	The polynomial $Q(x)$that satisfies $x^3 + 2x^2 - 3x - 7 = (x - 2)Q(x) + 3$ is written in its simplest form, $ax^2 + bx + c$. Find the value of $a + b + c$.
5	The point *P* divides the interval from $A(-4, -4)$ to $B(1,6)$ internally in the ratio $2:3$. Find the x-coordinate of *P*.
6	Find the term independent of x in the binomial expansion of $\left(x^2 - \frac{1}{x}\right)^9$.
7	A is an acute angle such that $\tan A = \frac{8}{15}$. $\sin 2A$ can be written in its simplest form as $\frac{p}{q}$. Evaluate $p + q$.
8	The equation of the tangent to the curve $y = \sqrt{x + 2}$ at the point (7, 3) can be written in its simplest form as $ax + by + c = 0$. What is the value of $a + b + c$?
9	An infinite geometric series has a first term of 8 and a limiting sum of 12. The common ratio can be written as $\frac{p}{q}$, in simplest form. Calculate $p + q$.
10	If the recurring decimal $1.\dot{2}$ is written in its simplest form $\frac{a}{b}$ where $a, b \in \mathbb{N}$, find the value of $a + b$.