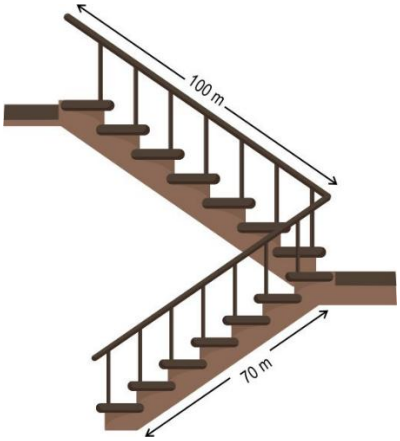
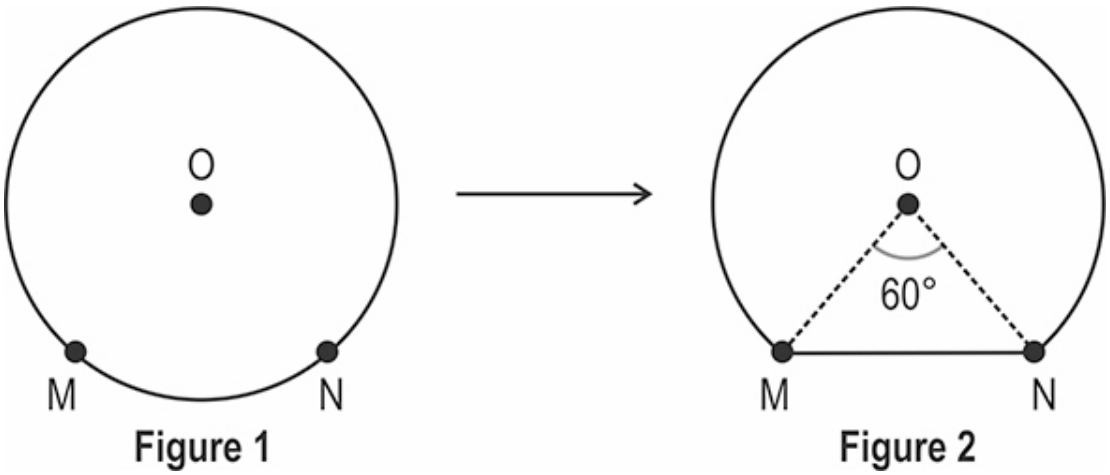
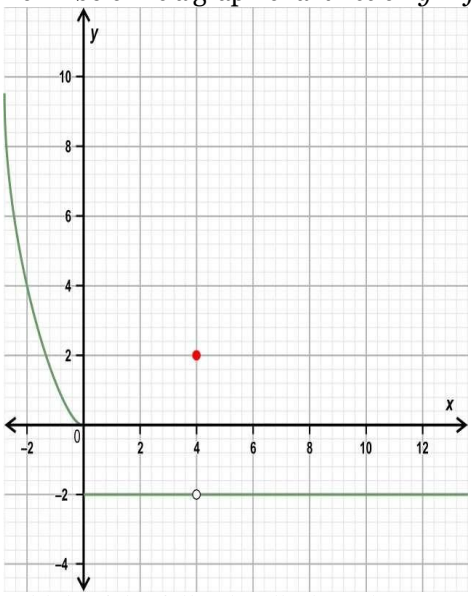
Ashoka Mathematics Challenge – Sample Questions

Mathematics Questions

1	Emma is a photographer who has just been hired by a magazine. In the first week, she submits 27 photos from her past work. Starting from the second week, she submits 3 new photos to the magazine every week. In which week does she submit her 120th photo? A. 12th week B. 23rd week C. 32nd week D. 40th week
2	Read the statements carefully and choose the option that correctly describes them. Statement 1: The function f(x) = (x^{34} + 10x + 25) is continuous in R. Statement 2: The function f(x) = (x^{34} + 10x + 25) is differentiable in R. *(Note: R = set of real numbers.)* A. Both statements are true and statement 2 explains why statement 1 is true. B. Both statements are true but statement 2 does NOT explain why statement 1 is true. C. Statement 1 is true but statement 2 is false. D. Statement 1 is false but statement 2 is true.
3	A person climbs a flight of stairs inclined at an angle of 60° to the horizontal for a distance of 70 meters. They then continue on a second flight of stairs inclined at 30° to the horizontal for a distance of 100 meters.  (Note: The figure is not to scale.)

	What is the total vertical height gained from the bottom to the top of the stairs? A. $(50 + 35\sqrt{3})$ m B. $(50\sqrt{3} + 35)$ m C. $\left(\frac{100}{\sqrt{3}} + 70\sqrt{3}\right)$ m D. $\left(\frac{70}{\sqrt{3}} + 100\sqrt{3}\right)$ m
4	In the circular sheet shown in Figure 1, O is the centre of the circle and M and N are points on the boundary of the circle. A part of the sheet is cut from M to N to form the shape in Figure 2 as shown.  The length of the curve MN in Figure 1 is 3 cm and the circumference of the circle is 18 cm. The measure of $\angle MON$ is 60°. What is the perimeter of the shape in Figure 2? A. 15 cm B. $15\frac{9}{\pi}$ cm C. $18\frac{9}{\pi}$ cm D. (cannot say with the given information)
5	Municipal Councillor is an elected representative through elections for a city's Municipal Corporation.

	Mr Ashwin and Mr Badri are two among the five people who are contesting in a municipal corporation election for the post of the Municipal Councillor. According to an opinion poll conducted before the election, the probability that Mr Ashwin wins the election is $\frac{1}{10}$ and the probability that Mr Badri wins the election is $\frac{2}{5}$. Which of the following is the probability that neither Mr Ashwin nor Mr Badri wins? *(Note: Assume that no two candidates get the same number of votes.)* A. $\frac{1}{2}$ B. $\frac{1}{10}$ C. $\frac{3}{5}$ D. $\frac{7}{10}$
6	A river monitoring station tracks the pollution level P(t) over time t (in days), which is modelled by the function: $P(t) = t^3 - 6t^2 + 9t + 4,\ 0 \leq t \leq 7$ For which interval(s) of t, is the pollution level increasing? A. $t \in (1, 3)$ B. $t \in (2, 7]$ C. $t \in [0, 2) \cup (2, 7]$ D. $t \in [0, 1) \cup (3, 7]$
7	If $y = \sin^{-1}\left(\frac{4}{5}\right)$, then what is the value of $\cos\frac{y}{2}$? A. $\frac{2}{\sqrt{5}}$ B. $\frac{1}{\sqrt{5}}$ C. $\frac{4}{5}$ D. $\frac{3}{5}$
8	N is a 3 × 3 matrix defined as:

	$$N = \begin{bmatrix} 3 & y & 9 \\ 2 & 4 & y \\ 1 & 2 & 3 \end{bmatrix}$$ If N^{-1} does not exist, what are the possible value(s) of y? A. only 5 B. only 6 C. only +5 and (−5) D. only +6 and (−6)
9	Shown below is a graph of a function $y = f(x)$.  Which of the following limits exist? (i) $\lim_{x \to 0} f(x)$ (ii) $\lim_{x \to 4} f(x)$ A. Only (i) B. Only (ii) C. Both (i) and (ii) D. Neither (i) nor (ii)
10	A food delivery application tracks the preferences of its customers. The application defines two sets: V: Customers who ordered only vegetarian food. D: Customers whose order contains dessert. The application has determined n(V) = 300, n(D) = 500 and n(V ∩ D) = 150. How many customers ordered either only vegetarian food or dessert but not both? A. 150 B. 500 C. 650 D. 800

11	Which two lines among the following are reflections of each other in the y-axis? (i) $\frac{2x}{3}+\frac{y}{2}=1$ (ii) $\frac{3x}{2}+\frac{y}{2}=1$ (iii) $-\frac{3x}{2}+\frac{y}{2}=1$ A. (i) and (ii) B. (ii) and (iii) C. (i) and (iii) D. (No two lines are reflections of each other in the y-axis.)

Logical Reasoning Questions

1	Netflix, originally a DVD rental service founded in 1667, pivoted to streaming in 2007 when broadband internet became widely accessible. The company further disrupted the entertainment industry in 2013 by releasing all episodes of House of Cards simultaneously, pioneering the binge-watching model. Traditional networks argued that weekly releases built sustained audience engagement. Netflix countered that viewer freedom drives higher satisfaction and loyalty. By 2020, Netflix had over 200 million subscribers globally, while traditional cable television subscriptions fell to their lowest levels in decades. The passage links the decline of cable television subscriptions to Netflix's rise. Which assumption is this relationship most dependent on? A. Cable networks failed to invest adequately in original programming during this period. B. Viewers who cancelled cable subscriptions did so primarily to switch to streaming platforms. C. Netflix's pricing is consistently lower than the average cable subscription cost. D. Broadband internet access expanded at the same rate across all global markets.
2	In the journal Science, the researchers report on their experiments on free-ranging squirrels, quantifying how they learn to leap from different types of launching pads– some bendy, some not–in just a few attempts, how they change their body orientation in mid-air based on the quality of their launch, and how they alter their landing manoeuvres in real-time, depending on the stability of the final perch. “As a model organism to understand the biological limits of balance and agility, I would argue that squirrels are second to none,” said Hunt, now an assistant professor of biomechanics at the University of Nebraska, Omaha. “If we try to understand how squirrels do this, then we may discover general principles of high-performance locomotion in the canopy and other complex terrains that apply to the movements of other animals and robots.” Which of the following best expresses the main principle of the argument above?

	A. Behaviour of a species in a closed scientific environment brings out the best potential that it may have to offer. B. It is possible that squirrels may replace other animals in assisting humans in policing and other like functions. C. The flexibility that squirrels have may not be replicated in robots as their joints are rigid and lack smooth movements. D. Kinetics of squirrels can help design and manufacture robots to be used for more agile activities.
3	Starlight and Co. purchases travel vouchers from frequent flyers who receive these vouchers from Paragon Airlines. The vouchers are then sold to customers at a price lower than what they would typically pay for tickets directly from Paragon Airlines. This practice causes Paragon Airlines to lose potential revenue. To reduce the resale of these travel vouchers, Paragon Airlines should consider limiting: A. The time period during which the vouchers remain valid after issuance. B. The use of vouchers strictly to the individuals who received them. C. The specific routes on which the vouchers can be redeemed. D. The number of vouchers a person can earn in a single year.
4	The fallacy of division is a common mistake where one assumes that what is true for the whole of something must also be true for its parts. Which of the following would make for a good example of the fallacy of division? A. The orchestra is renowned for its exceptional musicianship; therefore, each musician must play an important role in the symphony. B. The team is known for its exceptional players; therefore, each player must contribute significantly to the team's success. C. The company has a reputation for its innovation; thus, they are likely to favour creative people while hiring. D. The country is known for its language diversity; hence, every person there must be at least bilingual.