MATHEMATICS (BASIC)

Code No. 241

SAMPLE QUESTION PAPER — SET 1 | CLASS X

Time Allowed: 3 Hours **Maximum Marks: 80**

General Instructions:

1. This question paper contains 38 questions. All questions are compulsory.
2. The paper is divided into five Sections: A, B, C, D and E.
3. In Section A, Question numbers 1 to 18 are multiple choice questions (MCQs) and question numbers 19 and 20 are Assertion-Reason based questions, of 1 mark each.
4. In Section B, Question numbers 21 to 25 are Very Short Answer (VSA) type questions, carrying 2 marks each.
5. In Section C, Question numbers 26 to 31 are Short Answer (SA) type questions, carrying 3 marks each.
6. In Section D, Question numbers 32 to 35 are Long Answer (LA) type questions, carrying 5 marks each.
7. In Section E, Question numbers 36 to 38 are case-study based questions carrying 4 marks each, with sub-parts of 1, 1 and 2 marks respectively.
8. There is no overall choice. However, an internal choice has been provided in 2 questions of Section B, 2 questions of Section C and 2 questions of Section D. An internal choice is provided in all 2-mark sub-parts of Section E.
9. Draw neat figures wherever required. Take $\pi = 22/7$ wherever required, unless stated otherwise.
10. Use of calculators is not permitted.

SECTION A *Section A consists of 20 questions of 1 mark each.*		
1.	The exponent of 5 in the prime factorisation of 3125 is (A) 3 (B) 4 (C) 5 (D) 6	1
2.	If HCF (a, b) = 12 and $a \times b = 3456$, then LCM (a, b) is (A) 244 (B) 288 (C) 300 (D) 322	1
3.	If one zero of the polynomial $x^2 - 8x + k$ is 3, the other zero is (A) 3 (B) 5 (C) 8 (D) 11	1
4.	Which of the following is a quadratic equation? (A) $x + 1/x = 5$ (B) $x^2 - 5 = 0$ (C) $x^3 - x + 1 = 0$ (D) $2x - 7 = 0$	1
5.	The 10th term of the AP 2, 7, 12, ... is (A) 45 (B) 47 (C) 49 (D) 52	1
6.	For what value of k do the equations $x + 2y = 4$ and $5x + ky = 15$ represent parallel lines? (A) 6 (B) 8 (C) 10 (D) 12	1
7.	The distance of the point (6, 8) from the origin is (A) 8 units (B) 10 units (C) 12 units (D) 14 units	1
8.	The mid-point of the line segment joining (2, 3) and (4, 7) is	1

	(A) (2, 4) (B) (3, 5) (C) (4, 5) (D) (3, 4)	
9.	In △ABC, DE ∥ BC, with D on AB and E on AC. If AD = 2 cm, DB = 3 cm and AE = 3 cm, then EC equals (A) 3 cm (B) 4 cm (C) 4.5 cm (D) 5 cm	1
10.	If △ABC ~ △PQR with ratio of corresponding sides 2 : 3, the ratio of their areas is (A) 2 : 3 (B) 4 : 6 (C) 4 : 9 (D) 8 : 27	1
11.	The number of tangents that can be drawn from an external point to a circle is (A) 1 (B) 2 (C) 3 (D) infinite	1
12.	If sinθ = 3/5 (θ acute), then cosθ equals (A) 3/4 (B) 4/5 (C) 5/4 (D) 5/3	1
13.	$\sec^2\theta - \tan^2\theta$ equals (A) 0 (B) 1 (C) secθ (D) tanθ	1
14.	As the angle of elevation of the sun increases from 30° to 60°, the length of the shadow of a vertical pole (A) increases (B) decreases (C) remains the same (D) becomes double	1
15.	The area of a sector of a circle of radius 7 cm with a central angle of 90° is (π = 22/7) (A) 22 cm^2 (B) 38.5 cm^2 (C) 44 cm^2 (D) 77 cm^2	1
16.	The total surface area of a cube of side 5 cm is (A) 100 cm^2 (B) 125 cm^2 (C) 150 cm^2 (D) 175 cm^2	1
17.	The mean of the first five prime numbers (2, 3, 5, 7, 11) is (A) 5 (B) 5.6 (C) 6 (D) 7	1
18.	A die is thrown once. The probability of getting a number greater than 4 is (A) 1/6 (B) 1/3 (C) 1/2 (D) 2/3	1
19.	Assertion (A): The pair of equations x + 2y = 5 and 2x + 4y = 10 has infinitely many solutions. Reason (R): The pair $a_1x + b_1y = c_1$, $a_2x + b_2y = c_2$ has infinitely many solutions if $a_1/a_2 = b_1/b_2 = c_1/c_2$. (A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	1
20.	Assertion (A): sin60°cos30° + sin30°cos60° = 1. Reason (R): sin(A + B) = sinA cosB + cosA sinB.	1

	(A) Both A and R are true, and R is the correct explanation of A. (B) Both A and R are true, but R is not the correct explanation of A. (C) A is true but R is false. (D) A is false but R is true.	

	SECTION B *Section B consists of 5 questions of 2 marks each.*	
21.	(A) Show that $5 - \sqrt{3}$ is an irrational number. **OR** (B) Find the LCM and HCF of 96 and 404 by the prime factorisation method.	2
22.	If $\tan\theta = 1$, find the value of $\sin\theta + \cos\theta$.	2
23.	In $\triangle ABC$, $DE \parallel BC$. If $AD/DB = 3/5$ and $AE = 6$ cm, find EC.	2
24.	(A) Find the area of a circle whose circumference is 44 cm. ($\pi = 22/7$) **OR** (B) The radius of a circle is 14 cm. Find the length of an arc which subtends an angle of 60° at the centre.	2
25.	Find the sum of the first 15 terms of the AP 3, 7, 11, ...	2

	SECTION C *Section C consists of 6 questions of 3 marks each.*	
26.	Find the zeroes of the quadratic polynomial $x^2 - 5x + 6$ and verify the relationship between the zeroes and the coefficients.	3
27.	(A) Find the mode of the following data: Class: 0–10, 10–20, 20–30, 30–40, 40–50 Frequency: 5, 8, 15, 12, 6 **OR** (B) Find the mean of the following distribution by the direct method: Class: 0–10, 10–20, 20–30, 30–40, 40–50 Frequency: 4, 6, 10, 8, 2	3
28.	Prove that the lengths of tangents drawn from an external point to a circle are equal.	3
29.	(A) Prove that $(\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$. **OR** (B) If $\tan\theta = 3/4$, find the value of $(4\sin\theta - 3\cos\theta) / (4\sin\theta + 3\cos\theta)$.	3
30.	A bag contains 5 red, 4 blue and 3 green balls. A ball is drawn at random. Find the probability that	3

	the ball drawn is (i) red (ii) not blue (iii) green.	
31.	Solve the pair of linear equations $3x + 2y = 11$ and $2x + 3y = 4$ by the elimination method.	3

	SECTION D *Section D consists of 4 questions of 5 marks each.*	
32.	A train travels 180 km at a uniform speed. If the speed had been 9 km/h more, it would have taken 1 hour less for the same journey. Find the original speed of the train.	5
33.	(A) State and prove the Basic Proportionality Theorem. Using it, in $\triangle ABC$, $DE \parallel BC$ with $AD = 4$ cm, $DB = 6$ cm and $AC = 15$ cm; find AE. **OR** (B) In $\triangle PQR$, $PQ = 6$ cm, $QR = 8$ cm and $PR = 10$ cm. A circle is inscribed in the triangle touching all three sides. Find the radius of the incircle.	5
34.	(A) A toy is in the shape of a cone mounted on a hemisphere, both of radius 7 cm. If the height of the cone is 24 cm, find the total surface area of the toy. ($\pi = 22/7$) **OR** (B) A cylindrical bucket of height 32 cm and base radius 18 cm is filled with sand. The sand is emptied and poured to form a conical heap of height 24 cm. Find the radius of the conical heap.	5
35.	The following table shows the ages of 50 patients admitted to a hospital during a week: Age (years): 0–10, 10–20, 20–30, 30–40, 40–50, 50–60 Number of patients: 5, 8, 20, 10, 4, 3 Find the median age of the patients.	5

	SECTION E *Section E consists of 3 case-study based questions of 4 marks each.*	
36.	A drone delivery company marks three delivery hubs on a coordinate grid (distances in km): Hub P(1, 2), Hub Q(4, 6) and Hub R(7, 2). Based on the above, answer the following: (i) Find the distance between hub P and hub Q. [1] (ii) Find the coordinates of the mid-point of PR. [1] (iii) (A) Find the distance QR and state whether $\triangle PQR$ is isosceles. [2] **OR** (iii) (B) Find the point that divides PQ in the ratio 2 : 3 from P. [2]	4
37.	A theatre has 30 rows of seats. The first row has 20 seats, and each subsequent row has 2 more seats than the row before it. Based on the above, answer the following: (i) How many seats are there in the 15th row? [1] (ii) Find the total number of seats in the first 10 rows. [1]	4

	(iii) (A) Find the total number of seats in the theatre (all 30 rows). [2] **OR** (iii) (B) Which row has 68 seats? [2]	
38.	A lighthouse of height 60 m stands on the shore. Ships approaching it are observed from sea level. Based on the above, answer the following: (i) If a ship is at a distance of 60 m from the base of the lighthouse, find the angle of elevation of the top of the lighthouse from the ship. [1] (ii) If the angle of elevation from another ship is $30°$, find its distance from the lighthouse. [1] (iii) (A) If the angle of elevation changes from $60°$ to $30°$ as a ship sails away from the lighthouse, find the distance sailed by the ship. [2] **OR** (iii) (B) If a ship sails a distance of $60(\sqrt{3} - 1)$ m towards the lighthouse and the angle of elevation changes from $30°$ to θ, find θ. [2]	4

MATHEMATICS (BASIC)

Code No. 241 — Marking Scheme

MARKING SCHEME — SET 1 | CLASS X

SECTION A		
1.	$3125 = 5^5$. Exponent of 5 = 5. Answer: (C) 5	1
2.	LCM = (a×b)/HCF = 3456/12 = 288. Answer: (B) 288	1
3.	Sum of zeroes = 8. Other zero = 8 − 3 = 5. Answer: (B) 5	1
4.	$x^2 - 5 = 0$ is of the form $ax^2+bx+c=0$ with $a \neq 0$. Answer: (B)	1
5.	a=2, d=5. $a_{10} = 2+9(5) = 47$. Answer: (B) 47	1
6.	Parallel: $a_1/a_2 = b_1/b_2 \neq c_1/c_2$. 1/5 = 2/k ⇒ k=10. Answer: (C) 10	1
7.	Distance = $\sqrt{(6^2+8^2)} = \sqrt{100}$ = 10 units. Answer: (B) 10 units	1
8.	Mid-point = ((2+4)/2, (3+7)/2) = (3, 5). Answer: (B) (3, 5)	1
9.	By BPT: AD/DB = AE/EC ⇒ 2/3 = 3/EC ⇒ EC = 4.5 cm. Answer: (C) 4.5 cm	1
10.	Ratio of areas = $(2/3)^2 = 4/9$. Answer: (C) 4 : 9	1
11.	Exactly 2 tangents can be drawn from an external point. Answer: (B) 2	1
12.	$\sin^2\theta+\cos^2\theta=1 \Rightarrow \cos\theta=\sqrt{(1-9/25)}=4/5$. Answer: (B) 4/5	1
13.	$\sec^2\theta - \tan^2\theta = 1$ (identity). Answer: (B) 1	1
14.	As elevation increases, shadow length decreases. Answer: (B) decreases	1
15.	Area = (90/360)×(22/7)×49 = 38.5 cm^2. Answer: (B) 38.5 cm^2	1
16.	TSA = 6×5^2 = 150 cm^2. Answer: (C) 150 cm^2	1
17.	Mean = (2+3+5+7+11)/5 = 28/5 = 5.6. Answer: (B) 5.6	1
18.	Favourable: {5,6}. P = 2/6 = 1/3. Answer: (B) 1/3	1
19.	Both equations give ratio 1/2=2/4=5/10, so infinitely many solutions; R correctly states and explains the condition. Answer: (A)	1
20.	sin90°=1, and R (the sin(A+B) identity) directly derives this. Answer: (A)	1

SECTION B		
21.	(A) Let $5 - \sqrt{3} = p/q$ (rational, $q \neq 0$). Then $\sqrt{3} = 5 - p/q = (5q-p)/q$, a rational number. This contradicts $\sqrt{3}$ being irrational. Hence $5 - \sqrt{3}$ is irrational. [2] OR (B) $96 = 2^5 \times 3$; $404 = 2^2 \times 101$. HCF = 2^2 = 4. LCM = (96×404)/4 = 9696. [2]	2
22.	$\tan\theta=1 \Rightarrow \theta=45°$. $\sin\theta+\cos\theta = \sqrt{2}/2+\sqrt{2}/2 = \sqrt{2}$. [2]	2
23.	AD/DB = AE/EC ⇒ 3/5 = 6/EC ⇒ EC = 10 cm. [2]	2
24.	(A) $2\pi r = 44 \Rightarrow r = 7$ cm. Area = (22/7)(49) = 154 cm^2. [2] OR (B) Circumference = $2\pi r$ = 88 cm. Arc length = 88×(60/360) = 14.67 cm. [2]	2
25.	a=3,d=4,n=15. S_{15} = (15/2)[6+56] = (15/2)(62) = 465. [2]	2

SECTION C		
26.	$x^2-5x+6 = (x-2)(x-3)$. Zeroes: 2, 3. [1.5] Sum = 5 = −(−5)/1 ✓. Product = 6 = 6/1 ✓. [1.5]	3
27.	(A) Modal class (highest frequency 15) = 20–30. l=20, f_1=15, f_0=8, f_2=12, h=10. Mode = 20 + [(15−8)/(30−88−12)]×10 = 20 + (7/10)×10 = 27. [3] OR (B) Midpoints: 5,15,25,35,45. Σf=30, Σfx=730. Mean = 730/30 = 24.33. [3]	3
28.	Let PA, PB be two tangents from external point P touching the circle at A, B, with centre O. In △OAP and △OBP: OA=OB (radii), OP=OP (common), ∠OAP=∠OBP=90° (tangent ⊥ radius). By RHS congruence, △OAP ≅ △OBP, so PA = PB. [3]	3
29.	(A) LHS = $\sec^2\theta - \tan^2\theta$ = 1 (standard identity) = RHS. [3] OR (B) $\tan\theta$=3/4 ⇒ $\sin\theta$=3/5, $\cos\theta$=4/5. Numerator = 4(3/5)−3(4/5) = 12/5−12/5 = 0. So the expression = 0. [3]	3
30.	Total balls = 12. (i) P(red) = 5/12. (ii) P(not blue) = 1 − 4/12 = 8/12 = 2/3. (iii) P(green) = 3/12 = 1/4. [1 each]	3
31.	3x+2y=11 ...(i); 2x+3y=4 ...(ii). Multiply (i) by 3, (ii) by 2: 9x+6y=33; 4x+6y=8. Subtract: 5x=25 ⇒ x=5. From (i): 15+2y=11 ⇒ y=−2. [3]	3

SECTION D		
32.	Let original speed = x km/h. 180/x − 180/(x+9) = 1. 180(x+9) − 180x = x(x+9) ⇒ 1620 = x^2+9x ⇒ x^2+9x−1620=0.	5

	$x = [-9 \pm \sqrt{81+6480}]/2 = [-9 \pm 81]/2$. Positive root: $x = 36$. Original speed = 36 km/h. [5]	
33.	(A) Statement: If a line is drawn parallel to one side of a triangle, it divides the other two sides in the same ratio. [Proof: draw DE∥BC in △ABC; construct EM⊥AD and DN⊥AE; compare areas of △ADE, △BDE, △ADE, △CDE to show AD/DB = AE/EC.] [3] Application: $AD/DB = AE/EC \Rightarrow 4/6 = AE/EC$. With AE+EC=15 (=AC): let AE=4k, EC=6k ⇒ 10k=15 ⇒ k=1.5 ⇒ AE = 6 cm. [2] OR (B) $6^2+8^2=100=10^2$, so △PQR is right-angled at Q. Area = ½×6×8 = 24 cm^2. s = (6+8+10)/2 = 12. r = Area/s = 24/12 = 2 cm. [5]	5
34.	(A) $l = \sqrt{7^2+24^2} = \sqrt{625} = 25$ cm. TSA = $\pi r(l+2r) = (22/7)(7)(25+14) = 22\times39 = 858$ cm^2. [5] OR (B) Volume of sand = $\pi(18)^2(32) = 10368\pi$ cm^3 = Volume of cone = $(1/3)\pi R^2(24) = 8\pi R^2$. $8R^2 = 10368 \Rightarrow R^2 = 1296 \Rightarrow R = 36$ cm. [5]	5
35.	Cumulative frequencies: 5,13,33,43,47,50. n/2 = 25. Median class = 20–30 (cf just ≥25 is 33). l=20, cf=13, f=20, h=10. Median = 20+[(25−13)/20]×10 = 20+6 = 26 years. [5]	5

SECTION E		
36.	(i) $PQ = \sqrt{(4-1)^2+(6-2)^2} = \sqrt{9+16} = 5$ km. [1] (ii) Mid-point of PR = ((1+7)/2,(2+2)/2) = (4, 2). [1] (iii)(A) $QR = \sqrt{(7-4)^2+(2-6)^2} = \sqrt{25} = 5$ km. $PR = \sqrt{(7-1)^2+0^2} = 6$ km. Since PQ = QR = 5 km, △PQR is isosceles. [2] OR (iii)(B) Point dividing PQ in ratio 2:3 from P = ((2×4+3×1)/5, (2×6+3×2)/5) = (2.2, 3.6). [2]	4
37.	(i) a=20,d=2. a_{15} = 20+14(2) = 48 seats. [1] (ii) S_{10} = (10/2)[40+9(2)] = 5×58 = 290 seats. [1] (iii)(A) S_{30} = (30/2)[40+29(2)] = 15×98 = 1470 seats. [2] OR (iii)(B) 20+(n−1)2 = 68 ⇒ n−1 = 24 ⇒ n = 25th row. [2]	4
38.	(i) $\tan\theta = 60/60 = 1 \Rightarrow \theta = 45°$. [1] (ii) $\tan 30° = 60/d \Rightarrow d = 60\sqrt{3}$ m. [1] (iii)(A) At 60°: $d_1 = 60/\sqrt{3} = 20\sqrt{3}$ m. At 30°: $d_2 = 60\sqrt{3}$ m. Distance sailed = $60\sqrt{3}-20\sqrt{3} = 40\sqrt{3}$ m. [2] OR (iii)(B) Original distance at 30° = $60\sqrt{3}$. New distance = $60\sqrt{3} - 60(\sqrt{3}-1) = 60$ m. $\tan\theta = 60/60 = 1 \Rightarrow \theta = 45°$. [2]	4