MATHEMATICS (BASIC)

Code No. 241

SAMPLE QUESTION PAPER — SET 2 | 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 2 in the prime factorisation of 3600 is (A) 2 (B) 3 (C) 4 (D) 5	1
2.	If HCF (a, b) = 8 and $a \times b = 384$, then LCM (a, b) is (A) 36 (B) 42 (C) 48 (D) 56	1
3.	If one zero of the polynomial $x^2 + 7x + k$ is -3, the other zero is (A) -4 (B) 3 (C) 4 (D) -10	1
4.	Which of the following quadratic equations has real and equal roots? (A) $x^2 - 4x + 4 = 0$ (B) $x^2 - 2x + 5 = 0$ (C) $x^2 + 3x - 4 = 0$ (D) $2x^2 + 3x + 2 = 0$	1
5.	The common difference of the AP $-5, -1, 3, 7, \ldots$ is (A) 2 (B) 3 (C) 4 (D) 5	1
6.	For what value of k are the lines $x + 2y = 4$ and $5x + ky = 15$ parallel? (A) 8 (B) 10 (C) 12 (D) 15	1
7.	The distance between the points $(3, -2)$ and $(-3, 6)$ is (A) 8 units (B) 9 units (C) 10 units (D) 12 units	1
8.	The point which divides the join of (1, 1) and (7, 4) in the ratio 1 : 2 is	1

	(A) (2, 2) (B) (3, 2) (C) (3, 3) (D) (4, 2)	
9.	In △ABC, D and E are points on AB and AC such that DE ∥ BC. If AD = 3 cm, AB = 9 cm and AE = 4 cm, then AC equals (A) 8 cm (B) 10 cm (C) 12 cm (D) 16 cm	1
10.	△ABC ~ △DEF; their areas are 25 cm^2 and 36 cm^2. If BC = 5 cm, then EF equals (A) 5.5 cm (B) 6 cm (C) 6.5 cm (D) 7 cm	1
11.	If two circles touch each other externally, the number of common tangents is (A) 1 (B) 2 (C) 3 (D) 4	1
12.	If cosθ = 12/13 (θ acute), then sinθ equals (A) 5/13 (B) 5/12 (C) 12/5 (D) 13/5	1
13.	$(1 - \cos^2\theta)\,\text{cosec}^2\theta$ equals (A) 0 (B) 1 (C) cosθ (D) sinθ	1
14.	If a pole casts a shadow equal in length to its own height, the angle of elevation of the sun is (A) 30° (B) 45° (C) 60° (D) 90°	1
15.	The area of a semicircle of radius 14 cm is (π = 22/7) (A) 154 cm^2 (B) 231 cm^2 (C) 308 cm^2 (D) 616 cm^2	1
16.	A cube has total surface area 96 cm^2. Its volume is (A) 48 cm^3 (B) 56 cm^3 (C) 64 cm^3 (D) 72 cm^3	1
17.	The median of the data 4, 7, 9, 10, 12, 15 is (A) 9 (B) 9.5 (C) 10 (D) 10.5	1
18.	A card is drawn from a well-shuffled deck of 52 cards. The probability of getting a king is (A) 1/26 (B) 1/13 (C) 1/4 (D) 4/13	1
19.	Assertion (A): HCF(4, 6) = 2 and LCM(4, 6) = 12. Reason (R): For any two positive integers a and b, HCF(a, b) × LCM(a, b) = a × b. (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): In a right triangle with legs 6 cm and 8 cm, the hypotenuse is 10 cm. Reason (R): In a right triangle, the square of the hypotenuse equals the sum of the squares of the other two sides. (A) Both A and R are true, and R is the correct explanation of A.	1

	(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) Prove that $\sqrt{5}$ is an irrational number. **OR** (B) Find the HCF and LCM of 26 and 91 by the prime factorisation method.	2
22.	If $\cot\theta = 7/24$, find $\text{cosec}\,\theta$.	2
23.	In $\triangle ABC$, $DE \parallel BC$, $AD = 5$ cm, $AB = 15$ cm, and area($\triangle ADE$) = 20 cm^2. Find area($\triangle ABC$).	2
24.	(A) Find the area of a sector of a circle of radius 10 cm with central angle 72°. ($\pi = 3.14$) **OR** (B) The circumference of a circle exceeds its diameter by 45 cm. Find the radius. ($\pi = 22/7$)	2
25.	Find the 25th term of the AP 10, 6, 2, −2, ...	2

	SECTION C *Section C consists of 6 questions of 3 marks each.*	
26.	Find the zeroes of the quadratic polynomial $x^2 - 3x - 10$ and verify the relationship between the zeroes and the coefficients.	3
27.	(A) Find the mean of the following data using the assumed mean method: Class: 10–20, 20–30, 30–40, 40–50, 50–60 Frequency: 6, 8, 12, 9, 5 **OR** (B) Find the median of the following data: Class: 0–10, 10–20, 20–30, 30–40, 40–50 Frequency: 5, 9, 12, 10, 4	3
28.	Prove that the tangent at any point of a circle is perpendicular to the radius through the point of contact.	3
29.	If $\sin\theta + \cos\theta = \sqrt{2}$, prove that $\tan\theta + \cot\theta = 2$.	3
30.	A box contains 3 red, 5 white and 2 black balls. One ball is drawn at random. Find the probability that it is (i) white (ii) not black (iii) red or black.	3
31.	(A) Solve for x and y: $3x + 2y = 11$ and $2x + 3y = 4$. **OR**	3

	(B) A father's age is three times the sum of the ages of his two children. After 5 years, his age will be twice the sum of their ages. Find the father's present age.	

SECTION D *Section D consists of 4 questions of 5 marks each.*		
32.	The area of a rectangular field is 480 m^2. The length is 2 m more than twice its breadth. Find the dimensions of the field.	5
33.	(A) State and prove the Basic Proportionality Theorem. Using it, in △ABC, DE ∥ BC with AD = 2.4 cm, DB = 3.6 cm and AE = 3.2 cm; find EC. **OR** (B) The two shorter sides of a triangle are 15 cm and 20 cm, and its perimeter is 60 cm. Find the third side and check whether the triangle is right-angled.	5
34.	(A) A cylindrical pipe has inner radius 3.5 cm, outer radius 5 cm and length 21 cm. Find the volume of metal used to make the pipe. (π = 22/7) **OR** (B) A hemispherical bowl of radius 9 cm is full of liquid. The liquid is poured into cylindrical bottles of radius 3 cm and height 4 cm each. Find the number of bottles needed.	5
35.	The following table shows the daily wages (in ₹) of 50 workers of a factory: Wages (₹): 100–120, 120–140, 140–160, 160–180, 180–200 Number of workers: 12, 14, 8, 6, 10 Find the mean daily wage using the step-deviation method.	5

SECTION E *Section E consists of 3 case-study based questions of 4 marks each.*		
36.	Three friends Meera, Nisha and Om live at points M(2, 3), N(6, 3) and O(6, 7) respectively on a city map (units in km). Based on the above, answer the following: (i) Find the distance MN. [1] (ii) Find the mid-point of MO. [1] (iii) (A) Show that △MNO is right-angled, by finding all three side lengths and verifying Pythagoras' theorem. [2] **OR** (iii) (B) Find the point which divides MO in the ratio 3 : 1 from M. [2]	4
37.	A stack of logs is arranged so that the bottom row has 25 logs, and each row above has one fewer log than the row below it. Based on the above, answer the following: (i) Find the number of logs in the 15th row from the bottom. [1] (ii) If there are 20 rows in total, find the number of logs in the topmost (20th) row. [1]	4

	(iii) (A) Find the total number of logs used in the stack (all 20 rows). [2] **OR** (iii) (B) In which row will there be only 1 log, if the pattern were to continue? [2]	
38.	From the top of a 100 m tall office building, the angle of depression to cars parked on the ground is observed. Based on the above, answer the following: (i) If a car is at a horizontal distance of 100 m from the base of the building, find the angle of depression to the car. [1] (ii) If the angle of depression to another car is $30°$, find its distance from the base of the building. [1] (iii) (A) Two cars are on the same side of the building, with angles of depression $60°$ and $30°$ respectively. Find the distance between the two cars. [2] **OR** (iii) (B) If a car moves $100(\sqrt{3} - 1)$ m towards the building and the angle of depression changes from $30°$ to θ, find θ. [2]	4

MATHEMATICS (BASIC)

Code No. 241 — Marking Scheme

MARKING SCHEME — SET 2 | CLASS X

SECTION A		
1.	$3600 = 2^4 \times 3^2 \times 5^2$. Exponent of 2 = 4. Answer: (C) 4	1
2.	LCM = 384/8 = 48. Answer: (C) 48	1
3.	Sum of zeroes = −7. Other zero = −7−(−3) = −4. Answer: (A) −4	1
4.	$x^2-4x+4=0$: D=16−16=0 (equal roots). Answer: (A)	1
5.	d = −1−(−5) = 4. Answer: (C) 4	1
6.	Parallel: 1/5 = 2/k ⇒ k=10; and 4/15≠1/5, confirming distinct parallel lines. Answer: (B) 10	1
7.	Distance = $\sqrt{(6^2+8^2)}$ = 10 units. Answer: (C) 10 units	1
8.	Point = ((1×7+2×1)/3,(1×4+2×1)/3) = (3, 2). Answer: (B) (3, 2)	1
9.	AD/AB = AE/AC ⇒ 3/9 = 4/AC ⇒ AC = 12 cm. Answer: (C) 12 cm	1
10.	$25/36 = (5/EF)^2$ ⇒ EF = 6 cm. Answer: (B) 6 cm	1
11.	Two circles touching externally have 3 common tangents. Answer: (C) 3	1
12.	$\sin\theta = \sqrt{(1-144/169)} = 5/13$. Answer: (A) 5/13	1
13.	$(1-\cos^2\theta)\text{cosec}^2\theta = \sin^2\theta \times \text{cosec}^2\theta = 1$. Answer: (B) 1	1
14.	Shadow = height ⇒ $\tan\theta=1$ ⇒ $\theta=45°$. Answer: (B) 45°	1
15.	Full circle area = 616 cm^2; semicircle = 308 cm^2. Answer: (C) 308 cm^2	1
16.	$6a^2=96$ ⇒ a=4 cm. Volume = 64 cm^3. Answer: (C) 64 cm^3	1
17.	Median = (9+10)/2 = 9.5. Answer: (B) 9.5	1
18.	P(king) = 4/52 = 1/13. Answer: (B) 1/13	1
19.	2×12=24=4×6, confirming the formula. R correctly explains A. Answer: (A)	1
20.	$6^2+8^2=100=10^2$, and R (Pythagoras' theorem) is exactly why. Answer: (A)	1

SECTION B

21.	(A) Suppose $\sqrt{5} = p/q$ in lowest terms. Then $5q^2=p^2$, so p^2 is divisible by 5, hence p is divisible by 5. Let p=5m: $5q^2=25m^2 \Rightarrow q^2=5m^2$, so q is also divisible by 5 — contradicting that p/q was in lowest terms. Hence $\sqrt{5}$ is irrational. [2] OR (B) 26=2×13; 91=7×13. HCF=13. LCM = (26×91)/13 = 182. [2]	2
22.	$\cot\theta=7/24 \Rightarrow$ (7,24,25 triple) $\Rightarrow \operatorname{cosec}\theta = 25/24$. [2]	2
23.	Ratio of areas = $(AD/AB)^2 = (5/15)^2 = 1/9$. Area(ABC) = 20×9 = 180 cm^2. [2]	2
24.	(A) Area = (72/360)×3.14×100 = 0.2×314 = 62.8 cm^2. [2] OR (B) $2\pi r-2r=45 \Rightarrow 2r(22/7-1)=45 \Rightarrow 2r(15/7)=45 \Rightarrow r=10.5$ cm. [2]	2
25.	$a=10, d=-4$. $a_{25} = 10+24(-4) = -86$. [2]	2

SECTION C		
26.	$x^2-3x-10 = (x-5)(x+2)$. Zeroes: 5, −2. [1.5] Sum = 3 = −(−3)/1 ✓. Product = −10 = −10/1 ✓. [1.5]	3
27.	(A) Midpoints 15,25,35,45,55; A=35. fd: −120,−80,0,90,100. Σf=40, Σfd=−10. Mean = 35 + (−10/40) = 34.75. [3] OR (B) CF: 5,14,26,36,40. n/2=20. Median class 20–30 (cf=14, f=12). Median = 20+[(20−14)/12]×10 = 25. [3]	3
28.	Let the circle touch tangent XY at P, centre O. Join OP. Assume OP is not perpendicular to XY; then a line OM shorter than OP could be drawn to XY, but OM would then be less than the radius — impossible since OP is the shortest distance (radius) to the tangent line. Hence OP ⊥ XY, i.e., the tangent at any point is perpendicular to the radius through that point. [3]	3
29.	Squaring: $\sin^2\theta+\cos^2\theta+2\sin\theta\cos\theta = 2 \Rightarrow 1+2\sin\theta\cos\theta=2 \Rightarrow \sin\theta\cos\theta=1/2$. $\tan\theta+\cot\theta = (\sin^2\theta+\cos^2\theta)/(\sin\theta\cos\theta) = 1/(1/2) = 2$. [3]	3
30.	Total = 10. (i) P(white) = 5/10 = 1/2. (ii) P(not black) = 1−2/10 = 4/5. (iii) P(red or black) = 5/10 = 1/2. [1 each]	3
31.	(A) 3x+2y=11, 2x+3y=4. Multiply by 3 and 2: 9x+6y=33; 4x+6y=8. Subtract: 5x=25 ⇒ x=5, y=−2. [3] OR (B) Let sum of children's ages = x, father = 3x. After 5 yrs: 3x+5 = 2(x+10) ⇒ x=15. Father's present age = 45 years. [3]	3

SECTION D		
32.	Let breadth = b, length = 2b+2. b(2b+2)=480 ⇒ $2b^2+2b-480=0 \Rightarrow b^2+b-240=0$.	5

	$b = [-1+\sqrt{(1+960)}]/2 = [-1+31]/2 = 15$. Breadth = 15 m, Length = 32 m. [5]	
33.	(A) [BPT statement and proof as in Set 1.] Application: AD/DB = AE/EC ⇒ 2.4/3.6 = 3.2/EC ⇒ EC = (3.2×3.6)/2.4 = 4.8 cm. [5] OR (B) Third side = 60−15−20 = 25 cm. Check: $15^2+20^2 = 225+400 = 625 = 25^2$. Right-angled triangle (15–20–25 triple). [5]	5
34.	(A) Volume = $\pi(R^2-r^2)h = (22/7)(25-12.25)(21) = (22/7)(12.75)(21) = 841.5\ cm^3$. [5] OR (B) Volume of hemisphere = $(2/3)\pi(9)^3 = 486\pi$. Volume of 1 bottle = $\pi(3)^2(4) = 36\pi$. Number of bottles = $486\pi/36\pi = 13.5$ ⇒ 14 bottles are needed (13 are not enough). [5]	5
35.	Midpoints: 110,130,150,170,190. A=150,h=20. u: −2,−1,0,1,2. fu: −24,−14,0,6,20. Σf=50, Σfu=−12. Mean = 150 + 20×(−12/50) = 150−4.8 = 145.2. [5]	5

SECTION E		
36.	(i) MN = $\sqrt{(6-2)^2+0^2}$ = 4 km. [1] (ii) Mid-point of MO = ((2+6)/2,(3+7)/2) = (4, 5). [1] (iii)(A) NO = $\sqrt{0^2+4^2}$=4 km, MO=$\sqrt{4^2+4^2}=4\sqrt{2}$ km. $MN^2+NO^2 = 16+16 = 32 = MO^2$, so △MNO is right-angled at N. [2] OR (iii)(B) Point dividing MO in ratio 3:1 from M = ((3×6+1×2)/4,(3×7+1×3)/4) = (5, 6). [2]	4
37.	(i) a=25,d=−1. a_{15} = 25−14 = 11 logs. [1] (ii) a_{20} = 25−19 = 6 logs. [1] (iii)(A) S_{20} = (20/2)[50+19(−1)] = 10×31 = 310 logs. [2] OR (iii)(B) 25+(n−1)(−1)=1 ⇒ n−1=24 ⇒ n=25th row. [2]	4
38.	(i) tanθ = 100/100 = 1 ⇒ θ = 45°. [1] (ii) tan30° = 100/d ⇒ d = $100\sqrt{3}$ m. [1] (iii)(A) d_1(60°) = $100/\sqrt{3} = 100\sqrt{3}/3$ m. d_2(30°) = $100\sqrt{3}$ m. Distance between the two cars (same side) = $100\sqrt{3}-100\sqrt{3}/3 = 200\sqrt{3}/3$ m. [2] OR (iii)(B) Original distance at 30° = $100\sqrt{3}$ m. New distance = $100\sqrt{3} - 100(\sqrt{3}-1)$ = 100 m. tanθ = 100/100 = 1 ⇒ θ = 45°. [2]	4