MATHEMATICS (STANDARD)

Code No. 041

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.	If $p = 2^2 \times 3^3 \times 5$ and $q = 2^3 \times 3^2 \times 5^2$, then LCM(p, q) equals (A) 2700 (B) 4050 (C) 5400 (D) 8100	1
2.	Using Euclid's division: $210 = 55 \times q + r$. The values of q and r are (A) $q = 3, r = 45$ (B) $q = 4, r = -10$ (C) $q = 3, r = 40$ (D) $q = 2, r = 100$	1
3.	If the zeroes of $x^2 + (a + 1)x + b$ are 2 and −3, then the values of a and b are (A) $a = 0, b = -6$ (B) $a = 1, b = 6$ (C) $a = -1, b = -6$ (D) $a = 0, b = 6$	1
4.	The value of k for which $9x^2 + 3kx + 4 = 0$ has equal roots is (A) ±2 (B) ±4 (C) ±6 (D) ±8	1
5.	The 11th term from the end of the AP 7, 10, 13, ..., 151 is (A) 115 (B) 118 (C) 121 (D) 124	1
6.	The pair of equations $2x + ky = 5$ and $3x + 2y = 7$ has a unique solution when (A) $k \neq 4/3$ (B) $k = 4/3$ (C) $k \neq 3/4$ (D) $k = 3/4$	1
7.	If P(x, 4) lies on the segment joining A(−5, 8) and B(4, −10), then x equals (A) −4 (B) −3 (C) −2 (D) −1	1
8.	The centroid of a triangle is (2, 3). If two vertices are (5, 6) and (−1, 4), the third vertex is	1

	(A) (2, −1) (B) (1, −2) (C) (2, 1) (D) (−1, 2)	
9.	In △ABC, ∠B = 90° and BD ⊥ AC. If AD = 4 cm, DC = 9 cm, then BD equals (A) 5 cm (B) 6 cm (C) 6.5 cm (D) 7 cm	1
10.	△ABC ~ △PQR, ar(△ABC) : ar(△PQR) = 9 : 16. If PQ = 20 cm, then AB equals (A) 12 cm (B) 14 cm (C) 15 cm (D) 16 cm	1
11.	Two concentric circles have radii 5 cm and 3 cm. The length of a chord of the larger circle that touches the smaller circle is (A) 6 cm (B) 7 cm (C) 8 cm (D) 9 cm	1
12.	If sinA = 1/2 and cosB = 1/2 (A, B acute), then A + B equals (A) 60° (B) 75° (C) 90° (D) 120°	1
13.	If x = a sinθ, y = b cosθ, then $(x/a)^2 + (y/b)^2$ equals (A) 0 (B) 1 (C) ab (D) a/b	1
14.	From a point 60 m above a lake, the angle of elevation of a cloud is 30° and the angle of depression of its reflection is 60°. The height of the cloud above the lake is (A) 100 m (B) 110 m (C) 120 m (D) 130 m	1
15.	The perimeter of a sector of a circle of radius 5.7 cm is 27.2 cm. Its area is approximately (A) 35.5 cm² (B) 40.2 cm² (C) 45.0 cm² (D) 50.1 cm²	1
16.	A sphere of radius 6 cm is melted and recast into small spheres of radius 2 cm each. The number of small spheres formed is (A) 9 (B) 18 (C) 27 (D) 36	1
17.	For the data 3, 5, 7, x, 11, 13 (mean = 8), the value of x is (A) 7 (B) 8 (C) 9 (D) 10	1
18.	A ball is drawn at random from 20 balls numbered 1 to 20. The probability that the number is a multiple of 3 or 5 is (A) 9/20 (B) 1/2 (C) 11/20 (D) 2/5	1
19.	Assertion (A): If the sum of the first n terms of an AP is $3n^2 + n$, then its common difference is 6. Reason (R): For an AP, the common difference can be found as $d = a_2 - a_1$, where a_1 and a_2 are the first two terms obtained from Sn. (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): The tangent to a circle is perpendicular to the radius at the point of contact.	1

	Reason (R): A line perpendicular to a radius at its outer end must be tangent to the circle. (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) Prove that $7 - 3\sqrt{2}$ is an irrational number, given that $\sqrt{2}$ is irrational. **OR** (B) Three bells toll at intervals of 9, 12 and 15 minutes respectively. If they toll together at 8:00 a.m., find the next time they will all toll together.	2
22.	If $\sin\theta = \cos\theta$, find the value of $2\tan^2\theta + \sin^2\theta - 1$.	2
23.	The perimeters of two similar triangles ABC and DEF are 36 cm and 24 cm respectively. If DE = 10 cm, find AB.	2
24.	(A) Find the area of a sector of a circle of radius 6 cm if the corresponding arc length is 22 cm. ($\pi = 22/7$) **OR** (B) A horse is tied to a peg at one corner of a square-shaped grass field of side 15 m, by a rope 7 m long. Find the area the horse can graze.	2
25.	Find the sum of all two-digit numbers which are divisible by 4.	2

SECTION C *Section C consists of 6 questions of 3 marks each.*		
26.	Find the zeroes of the polynomial $6x^2 - 3 - 7x$ and verify the relationship between the zeroes and coefficients.	3
27.	(A) Find the mean of the following distribution using the assumed mean method: Class: 0–10, 10–20, 20–30, 30–40, 40–50 Frequency: 8, 10, 15, 12, 5 **OR** (B) Find the mode of the following distribution: Class: 10–20, 20–30, 30–40, 40–50, 50–60 Frequency: 6, 12, 20, 15, 7	3
28.	A circle is inscribed in $\triangle ABC$, touching AB, BC and CA at P, Q and R respectively. If AB = 10 cm, BC = 8 cm and CA = 12 cm, find the lengths AP, BQ and CR.	3
29.	(A) Prove that: $\tan\theta/(1 - \cot\theta) + \cot\theta/(1 - \tan\theta) = 1 + \sec\theta\cdot\text{cosec}\,\theta$.	3

	OR (B) If $\sin\theta + \sin^2\theta = 1$, prove that $\cos^2\theta + \cos^4\theta = 1$.	
30.	All the jacks, queens, kings and aces are removed from a deck of 52 playing cards. The remaining cards are shuffled and a card is drawn at random. Find the probability of getting (i) a club, (ii) a red card, (iii) a card of number 8.	3
31.	(A) A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream. **OR** (B) Two water taps together can fill a tank in 6 hours. The tap of larger diameter takes 5 hours less than the smaller one to fill the tank separately. Find the time each tap takes to fill the tank separately.	3

SECTION D *Section D consists of 4 questions of 5 marks each.*		
32.	The sum of the squares of two consecutive positive even numbers is 244. Find the numbers.	5
33.	(A) Prove that if in two triangles, corresponding angles are equal, then their corresponding sides are in the same ratio, and the triangles are similar. Hence, in $\triangle ABC$ and $\triangle DEF$, $\angle A = \angle D$, $\angle B = \angle E$, AB = 8 cm, DE = 6 cm and area($\triangle ABC$) = 48 cm². Find area($\triangle DEF$). **OR** (B) Prove that the diagonals of a trapezium divide each other proportionally. Hence, in trapezium ABCD with $AB \parallel CD$, diagonals AC and BD meet at O. If AO = 3 cm, OC = 6 cm and BO = 4 cm, find OD.	5
34.	(A) A bucket, open at the top, is in the form of a frustum of a cone with capacity 12308.8 cm³. The radii of the top and bottom are 20 cm and 12 cm. Find the height of the bucket. ($\pi = 3.14$) **OR** (B) A cone of height 24 cm and base radius 6 cm, made of modelling clay, is reshaped into a sphere. Find the radius of the sphere.	5
35.	The following data gives the observed lifetimes (in hours) of 225 electrical components: Lifetime (hrs): 0–20, 20–40, 40–60, 60–80, 80–100, 100–120 Frequency: 10, 35, 52, 61, 38, 29 Find the median lifetime of the components.	5

SECTION E *Section E consists of 3 case-study based questions of 4 marks each.*		
36.	A surveyor marks three landmarks on a map using a coordinate grid (units in km): X(1, 2), Y(9, 2) and Z(5, 10). Based on the above, answer the following: (i) Find the distance XY. [1]	4

	(ii) Find the mid-point of XZ. [1] (iii) (A) Find the distance YZ and check whether $\triangle XYZ$ is isosceles. [2] **OR** (iii) (B) Find the coordinates of the point which divides YZ in the ratio 1 : 3 from Y. [2]	
37.	A person saves ₹500 in the first month and increases the savings by ₹150 every subsequent month. Based on the above, answer the following: (i) How much does the person save in the 8th month? [1] (ii) Find the total savings in the first 6 months. [1] (iii) (A) In which month will the savings first exceed ₹3000? [2] **OR** (iii) (B) Find the total savings over the first year (12 months). [2]	4
38.	A drone hovering at a height of 80 m observes two vehicles on a straight road, one on each side of the point directly below it, at angles of depression of 45° and 60°. Based on the above, answer the following: (i) Find the horizontal distance of the vehicle observed at 45° from the point below the drone. [1] (ii) Find the horizontal distance of the vehicle observed at 60° from the point below the drone. [1] (iii) (A) Find the distance between the two vehicles, assuming they are on opposite sides of the point below the drone. [2] **OR** (iii) (B) If both vehicles are on the same side, find the distance between them. [2]	4

MATHEMATICS (STANDARD)

Code No. 041 — Marking Scheme

MARKING SCHEME — SET 2 | CLASS X

SECTION A		
1.	LCM: max exponents $2^3 \times 3^3 \times 5^2 = 8 \times 27 \times 25 = 5400$. Answer: (C) 5400	1
2.	$210 = 55 \times 3 + 45 \Rightarrow q=3, r=45$. Answer: (A) q=3, r=45	1
3.	Sum$=-1=-(a+1) \Rightarrow a=0$. Product$=-6=b$. Answer: (A) a=0, b=−6	1
4.	$D = 9k^2 - 144 = 0 \Rightarrow k^2=16 \Rightarrow k=\pm 4$. Answer: (B) ±4	1
5.	nth from end $= l-(n-1)d = 151-30 = 121$. Answer: (C) 121	1
6.	Unique solution needs $a_1/a_2 \neq b_1/b_2$: $2/3 \neq k/2 \Rightarrow k \neq 4/3$. Answer: (A) k≠4/3	1
7.	Solving via ratio k=2/7: $x = -3$. Answer: (B) −3	1
8.	$(4+x)/3=2 \Rightarrow x=2$; $(10+y)/3=3 \Rightarrow y=-1$. Answer: (A) (2, −1)	1
9.	$BD^2 = AD \times DC = 36 \Rightarrow BD = 6$ cm. Answer: (B) 6 cm	1
10.	Side ratio $= \sqrt{(9/16)} = 3/4$. $AB = 20 \times 3/4 = 15$ cm. Answer: (C) 15 cm	1
11.	Half-chord $= \sqrt{(25-9)} = 4$. Full chord = 8 cm. Answer: (C) 8 cm	1
12.	$A=30°$ ($\sin A=1/2$), $B=60°$ ($\cos B=1/2$). $A+B=90°$. Answer: (C) 90°	1
13.	$(x/a)^2+(y/b)^2 = \sin^2\theta+\cos^2\theta = 1$. Answer: (B) 1	1
14.	$3(h-60) = h+60 \Rightarrow 2h=240 \Rightarrow h=120$ m. Answer: (C) 120 m	1
15.	$l = 27.2-11.4 = 15.8$ cm. Area $= \frac{1}{2}(5.7)(15.8) \approx 45.0$ cm². Answer: (C) 45.0 cm²	1
16.	Ratio $(6/2)^3 = 27$ small spheres. Answer: (C) 27	1
17.	Sum=48; 3+5+7+11+13=39; x=48−39=9. Answer: (C) 9	1
18.	Multiples of 3 or 5: 6+4−1=9. P=9/20. Answer: (A) 9/20	1
19.	$a_1=4, a_2=10 \Rightarrow d=6$, matching the assertion; R gives a valid method that yields this d. Answer: (A)	1
20.	Both statements are true individually, but R (the converse) does not directly explain why A holds. Answer: (B)	1

SECTION B		
21.	(A) Assume $7-3\sqrt{2} = p/q$. Then $\sqrt{2} = (7-p/q)/3$, rational — contradicts $\sqrt{2}$ irrational. Hence $7-3\sqrt{2}$ is irrational. [2] OR (B) LCM(9,12,15) = 180 minutes = 3 hours. Next toll together at 11:00 a.m. [2]	2
22.	$\sin\theta=\cos\theta \Rightarrow \theta=45°$, $\tan\theta=1$, $\sin\theta=\sqrt{2}/2$. Expression = 2(1)+0.5−1 = 1.5. [2]	2
23.	Ratio = 36/24 = 3/2. AB = 10×3/2 = 15 cm. [2]	2
24.	(A) Area = ½×6×22 = 66 cm^2. [2] OR (B) Quarter-circle (corner of square): area = (90/360)(22/7)(49) = 38.5 m^2. [2]	2
25.	Multiples of 4 from 12 to 96: n=22. Sum = (22/2)(12+96) = 1188. [2]	2

SECTION C		
26.	$6x^2-7x-3 = (2x-3)(3x+1)$. Zeroes: 3/2, −1/3. [1.5] Sum = 7/6 = −(−7)/6 ✓. Product = − 1/2 = −3/6 ✓. [1.5]	3
27.	(A) Midpoints 5,15,25,35,45; A=25. fd: −160,−100,0,120,100. Σfd=−40. Mean = 25−0.8 = 24.2. [3] OR (B) Modal class 30–40 (f=20). Mode = 30+[(20−12)/(40−12−15)]×10 = 30+6.15 = 36.15. [3]	3
28.	Let AP=AR=x, BP=BQ=y, CQ=CR=z (equal tangents from each vertex). x+y=10, y+z=8, z+x=12. Adding: x+y+z=15. x = 15−8 = 7 cm, y = 15−12 = 3 cm, z = 15−10 = 5 cm. AP = 7 cm, BQ = 3 cm, CR = 5 cm. [3]	3
29.	(A) LHS = $s^2/(c(s-c)) - c^2/(s(s-c)) = (s^3-c^3)/(sc(s-c)) = (s^2+sc+c^2)/sc = (1+sc)/sc = 1/(sc)+1$ = $\sec\theta\operatorname{cosec}\theta+1$ = RHS. [3] OR (B) $\sin\theta=1-\sin^2\theta=\cos^2\theta$. $\cos^2\theta+\cos^4\theta = \cos^2\theta(1+\cos^2\theta) = \sin\theta(1+\sin\theta) = \sin\theta+\sin^2\theta = 1$ (given). [3]	3
30.	Remaining cards = 36 (numbers 2–10 in each suit). (i) P(club) = 9/36 = 1/4. (ii) P(red) = 18/36 = 1/2. (iii) P(number 8) = 4/36 = 1/9. [1 each]	3
31.	(A) $24/(18-x) - 24/(18+x) = 1 \Rightarrow 48x = 324-x^2 \Rightarrow x^2+48x-324=0 \Rightarrow x = 6$ km/h. [3] OR (B) $1/x+1/(x-5)=1/6 \Rightarrow x^2-17x+30=0 \Rightarrow x=15$ (rejecting x=2). Smaller tap: 15 hrs; larger tap: 10 hrs. [3]	3

SECTION D		
32.	Let numbers = 2n, 2n+2. $(2n)^2+(2n+2)^2 = 244 \Rightarrow 8n^2+8n-40$... simplifying: $n^2+n-30=0 \Rightarrow n=5$.	5

	Numbers: 10 and 12. [5]	
33.	(A) [AA similarity proof via BPT, as standard.] Ratio of areas = $(AB/DE)^2 = (8/6)^2 = 16/9$. area(DEF) = 48×9/16 = 27 cm^2. [5] OR (B) [Proof via AA similarity of △AOB and △COD, since AB∥CD.] AO/OC = BO/OD ⇒ 3/6=4/OD ⇒ OD = 8 cm. [5]	5
34.	(A) $V = (1/3)\pi h(R^2+r^2+Rr)$ ⇒ 12308.8 = (1/3)(3.14)h(400+144+240) = 820.59h ⇒ h = 15 cm. [5] OR (B) Vol(cone)=$(1/3)\pi(6)^2(24)=288\pi$ = Vol(sphere)=$(4/3)\pi R^3$ ⇒ $R^3=216$ ⇒ R=6 cm. [5]	5
35.	CF: 10,45,97,158,196,225. n/2=112.5. Median class 60–80 (cf=97,f=61). Median = 60+[(112.5−97)/61]×20 = 60+5.08 ≈ 65.08 hrs. [5]	5

SECTION E		
36.	(i) XY = $\sqrt{(8^2+0^2)}$ = 8 km. [1] (ii) Mid-point of XZ = ((1+5)/2,(2+10)/2) = (3, 6). [1] (iii)(A) YZ = $\sqrt{((-4)^2+8^2)}$ = $4\sqrt{5}$ km. XZ = $\sqrt{(4^2+8^2)}$ = $4\sqrt{5}$ km. Since YZ=XZ, △XYZ is isosceles. [2] OR (iii)(B) Point dividing YZ in ratio 1:3 from Y = ((1×5+3×9)/4,(1×10+3×2)/4) = (8, 4). [2]	4
37.	(i) a=500,d=150. a_8 = 500+7(150) = 1550. [1] (ii) S_6 = (6/2)[1000+5(150)] = 3×1750 = 5250. [1] (iii)(A) a_n > 3000: 500+(n−1)150>3000 ⇒ n>17.67. Check a_{18}=3050>3000, a_{17}=2900<3000. First exceeds in the 18th month. [2] OR (iii)(B) S_{12} = (12/2)[1000+11(150)] = 6×2650 = 15900. [2]	4
38.	(i) tan45° = $80/d_1$ ⇒ d_1 = 80 m. [1] (ii) tan60° = $80/d_2$ ⇒ $d_2 = 80/\sqrt{3} = 80\sqrt{3}/3$ m. [1] (iii)(A) (Opposite sides) Distance = d_1+d_2 = $80+80\sqrt{3}/3 = (240+80\sqrt{3})/3$ m. [2] OR (iii)(B) (Same side) Distance = d_1-d_2 = $80-80\sqrt{3}/3 = (240-80\sqrt{3})/3$ m. [2]	4