CBSE BOARD QUESTION PAPER-2018

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

General Instructions:

(*i*) All questions are **compulsory**.

(*ii*) The question paper consists of **30** questions divided into four sections-**A**, **B**, **C** and **D**.

(*iii*) Section **A** contains **6** questions of **1** mark each, Section **B** contains **6** questions of **2** marks each, Section **C** contains **10** questions of **3** marks each and Section **D** contains **8** questions of **4** marks each.

(*iv*) Use of calculators is not permitted.

SECTION A

Question Numbers 1 to 6 carry 1 Mark each.

Q1. What is the value of $(\cos^2 67° - \sin^2 23°)$?

Q2. In an AP, if the common difference $(d) = -4$, and the seventh term (a_7) is 4, then find the first term.

Q3. Given $\Delta ABC \sim \Delta PQR$, if $\frac{AB}{PQ} = \frac{1}{3}$, then find $\frac{ar\Delta ABC}{ar\Delta PQR}$.

Q4. What is the HCF of smallest prime number and the smallest composite number?

Q5. Find the distance of a point P(x,y) from the origin.

Q6. If $x = 3$ is one root of the quadratic equation $x^2 - 2kx - 6 = 0$, then find the value of k.

SECTION B

Question Number 7 to 12 carry 2 Marks each.

Q7. Two different dice are tossed together. Find the probability:

(*i*) of getting a doublet.

(*ii*) of getting a sum 10, of the numbers on the two dice.

Q8. Find the ratio in which P(4,m) divides the line segment joining the points A (2,3) and B(6,–3). Hence find m.

Q9. An integer is chosen at random between 1 and 100. Find the probability that it is:

(*i*) divisible by 8.

(*ii*) not divisible by 8.

Q10. In Fig. 1, ABCD is a rectangle. Find the values of x and y.

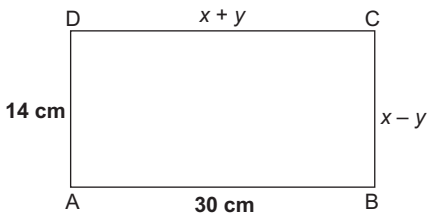


Fig. 1

Q11. Find the sum of first 8 multiples of 3.

Q12. Given that $\sqrt{2}$ is irrational, prove that $(5+3\sqrt{2})$ is an irrational number. **2**

SECTION C

Question Numbers 13 to 22 carry 3 Marks each.

Q13. If A(–2,1), B(a, 0), C(4, b) and D(1, 2) are the vertices of a parallelogram ABCD, find the values of a and b. Hence find the lengths of its sides.

OR

If A(–5,7), B(–4, –5), C(–1, –6) and D(4,5) are the vertices of a quadrilateral, find the area of the quadrilateral ABCD.

Q14. Find all zeroes of the polynomial $(2x^4 - 9x^3 + 5x^2 + 3x - 1)$ if two of its zeroes are $(2+\sqrt{3})$ and $(2-\sqrt{3})$

Q15. Find HCF and LCM of 404 and 96 and verify that HCF × LCM = product of the two given numbers.

Q16. Prove that the lengths of tangents drawn from an external point to a circle are equal.

Q17. Prove that the area of an equilateral triangle described on one side of the square is equal to half the area of the equilateral triangle described on one of its diagonal.

OR

If the area of two similar triangles are equal, prove that they are congruent.

Q18. A plane left 30 minutes late than its scheduled time and in order to reach the destination 1500 km away in time, it had to increase its speed by 100 km/h from the usual speed. Find its usual speed.

Q19. The table below shows the salaries of 280 persons:

Salary (In thousand ₹)	No. of Persons
5 – 10	49
10 – 15	133
15 – 20	63
20 – 25	15
25 – 30	6
30 – 35	7
35 – 40	4
40 – 45	2
45 – 50	1

Calculate the median salary of the data.

Q20. A wooden article was made by scooping out a hemisphere from each end of a solid cylinder, as shown in Fig.2. If the height of the cylinder is 10cm and its base is of radius 3.5cm. Find the total surface area of the article.

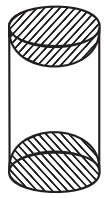


Fig. 2

A heap of rice is in the form of a cone of base diameter 24 m and height 3.5 m. Find the volume of the rice. How much canvas cloth is required to just cover the heap?

Q21. Find the area of the shaded region in Fig. 3, where arcs drawn with centres A, B, C and D intersect in pairs at mid-points P, Q, R and S of the sides AB, BC, CD and DA respectively of a square ABCD of side 12cm. [Use $\pi = 3.14$]

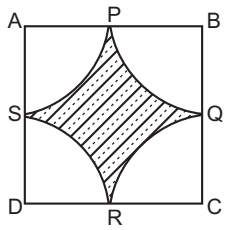


Fig. 3

Q22. If $4 \tan \theta = 3$, evaluate $\left(\frac{4 \sin \theta - \cos \theta + 1}{4 \sin \theta + \cos \theta - 1}\right)$

OR

If $\tan 2A = \cot (A - 18°)$, where 2A is an acute angle, find the value of A.

SECTION D

Question Numbers 23 to 30 carry 4 Marks each.

Q23. As observed from the top of a 100 m high light house from the sea-level, the angles of depression of two ships are 30° and 45°. If one ship is exactly behind the other on the same side of the light house, find the distance between the two ships. [Use $\sqrt{3} = 1.732$]

Q24. The diameters of the lower and upper ends of a bucket in the form of a frustum of a cone are 10 cm and 30cm respectively. If its height is 24 cm, find:

(*i*) The area of the metal sheet used to make the bucket.

(*ii*) Why we should avoid the bucket made by ordinary plastic? [Use $\pi = 3.14$]

Q25. Prove that: $\frac{\sin A - 2 \sin^3 A}{2 \cos^3 A - \cos A} = \tan A$

Q26. The mean of the following distribution is 18. Find the frequency *f* of the class 19–21.

Class	11–13	13–15	15–17	17–19	19–21	21–23	23–25
Frequency	3	6	9	13	*f*	5	4

OR

The following distribution gives the daily income of 50 workers of a factory:

Daily income (in ₹)	100–120	120–140	140–160	160–180	180–200
Number of workers	12	14	8	6	10

Convert the distribution above to a less than type cumulative frequency distribution and draw its ogive

Q27. A motor boat whose speed is 18 km/hr in still water takes 1 hr more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream.

OR

A train travels at a certain average speed for a distance of 63 km and then travels at a distance of 72 km at an average speed of 6 km/hr more than its original speed. If it takes 3 hours to complete total journey, what is the original average speed?

Q28. The sum of four consecutive numbers in an AP is 32 and the ratio of the product of the first and the last term to the product of two middle terms is 7:15. Find the numbers. **4**

Q29. Draw a triangle ABC with BC = 6 cm, AB = 5 cm and $\angle ABC = 60°$. Then construct a triangle whose sides are $\frac{3}{4}$ of the corresponding sides of the ΔABC.

Q30. In an equilateral ΔABC, D is a point on side BC such that BD = $\frac{1}{3}$ BC. Prove that $9(AD)^2 = 7(AB)^2$ **4**

OR

Prove that, in a right triangle, the square on the hypotenuse is equal to the sum of the square on the other two sides. **4**

CBSE MARKING SCHEME OF BOARD QUESTION PAPER-2018

SECTION A

1. $\because$ $\cos 67° = \sin 23°$ **1**

$\therefore$ $\cos^2 67° - \sin^2 23 = 0$

2. $a + 6(-4) = 4$ ½

$\Rightarrow$ $a = 28$ ½

3. $\frac{\text{ar } \Delta ABC}{\text{ar } \Delta PQR} = \frac{AB^2}{PQ^2}$

$= \left(\frac{1}{3}\right)^2 = \frac{1}{9}$ **1**

4. The required numbers are 2 and 4 ½

HCF of 2 and 4 is 2

5. OP = $\sqrt{x^2 + y^2}$ **1**

6. $x = 3$ is one root of the equation

$\therefore$ $9 - 6k - 6 = 0$ ½

$\Rightarrow$ $k = \frac{1}{2}$ ½

SECTION B

7. Total number of possible outcomes = 36

(*i*) Doublets are (1, 1), (2, 2), (3, 3), (4, 4), (5, 5), (6, 6) ½

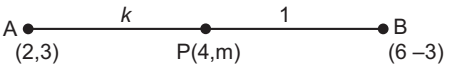
Total number of doublets = 6 ½

$\therefore$ Prob (getting a doublet) = $\frac{6}{36}$ or $\frac{1}{6}$ ½

(*ii*) Favourable outcomes are (4, 6), (5, 5), (6, 4) i.e., 3 ½

$\therefore$ Prob (getting a sum 10) = $\frac{3}{36}$ or $\frac{1}{12}$

8. Let AP : PB = k : 1



$\therefore$ $\frac{6k + 2}{k + 1} = 4$ 1

$\Rightarrow$ $k = 1$, ratio is 1:1 ½

Hence $m = \frac{-3 + 3}{2} = 0$ ½

9. Total number of outcomes = 98 ½

(*i*) Favourable outcomes are 8, 16, 24,.....96 i.e., 12 ½

$\therefore$ Prob (integer is divisible by 8) = $\frac{12}{98}$ or $\frac{6}{49}$ ½

(*ii*) Prob (integer is not divisible by 8) = $1 - \frac{6}{49} = \frac{43}{49}$ ½

10. AB = DC and BC = AD

$\Rightarrow$ $x + y = 30$

and $x - y = 14$ } 1

Solving to get $x = 22$ and $y = 8$ ½ + ½

11. $8 = 3 + 6 + 9 + 12 + ... + 24$

$= 3(1 + 2 + 3 + ... + 8)$ ½

$= 3 \times \frac{8 \times 9}{2}$ ½

$= 108$ ½

12. Let us assume $5 + 3\sqrt{2}$ is a rational number

$\therefore 5 + 3\sqrt{2} = \frac{p}{q}$ where $q \neq 0$ and p and q are integers ½

$\Rightarrow \sqrt{2} = \frac{p - 5q}{3q}$ ½

$\Rightarrow \sqrt{2}$ is a rational number as RHS is rational . ½

This contradicts the given fact that $\sqrt{2}$ is irrational. ½

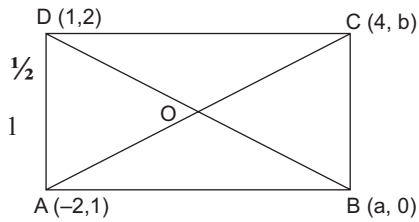
Hence $5 + 3\sqrt{2}$ is an irrational number. ½

SECTION C

13. ABCD is a parallelogram

$\therefore$ diagonals AC and BD bisect each other

Therefore, mid-point of BD is same as mid-point of AC ½



$\Rightarrow \left(\frac{a+1}{2}, \frac{2}{2}\right) = \left(\frac{-2+4}{2}, \frac{b+1}{2}\right)$ 1

$\Rightarrow \frac{a+1}{2} = 1$ and $\frac{b+1}{2} = 1$

$\Rightarrow a = 1, b = 1$. Therefore length of sides are $\sqrt{10}$ units each. ½ + 1

OR

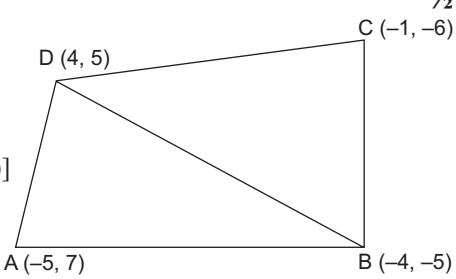
Area of quad. ABCD = ar (ΔABD) + ar (ΔBCD) ½

Area of $\Delta ABD = \frac{1}{2}[(-5)(-5-5) + (-4)(5-7) + (4)(7+5)]$

$= 53$ sq units 1

Area of $ABCD = \frac{1}{2}[(-4)(-6-5) + (-1)(5+5) + 4(-5+6)]$

$= 19$ sq units 1



Hence area of quad. ABCD = 53 + 19 = 72 sq units ½

14. $p(x) = 2x^4 - 9x^3 + 5x^2 + 3x - 1$

$2 + \sqrt{3}$ and $2 - \sqrt{3}$ are zeroes of $p(x)$

$\therefore p(x) = (x - 2 - \sqrt{3})(x - 2 + \sqrt{3}) \times g(x)$ 1

$= (x^2 - 4x + 1)g(x)$ 1

$(2x^4 - 9x^3 + 5x^2 + 3x - 1) \div (x^2 - 4x + 1) = 2x^2 - x - 1$

$\therefore g(x) = 2x^2 - x - 1$

$= (2x + 1)(x - 1)$

Therefore other zeroes are $x = -\frac{1}{2}$ and $x = 1$

$\therefore$ Therefore all zeroes are $2+\sqrt{3}$, $2-\sqrt{3}$,$-\frac{1}{2}$ and 1 1

15. $404 = 2 \times 2 \times 101 = 2^2 \times 101$

$96 = 2 \times 2 \times 2 \times 2 \times 2 \times 3 = 2^5 \times 3$

$\therefore$ HCF of 404 and 96 $= 2^2 = 4$ 1

LCM of 404 and 96 $= 101 \times 2^5 \times 3 = 9696$ 1

HCF $\times$ LCM $= 4 \times 9696 = 38784$

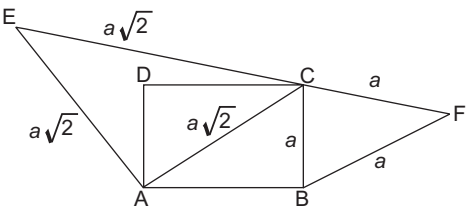
Also $404 \times 96 = 38784$

Hence HCF $\times$ LCM = Product of 404 and 96. 1

16. Correct given, to prove, figure, construction, ½ × 4 = 2

Correct proof 1

17. Let the side of the square be 'a' units



$\therefore AC^2 = a^2 + a^2 = 2a^2$

$\Rightarrow AC = \sqrt{2}a$ units 1

Area of equilateral $\Delta BCF = \frac{\sqrt{3}}{4}a^2$ sq.u ½

Area of equilateral $\Delta ACE = \frac{\sqrt{3}}{4}(\sqrt{2}\,a)^2 = \frac{\sqrt{3}}{2}a^2$ sq.u 1

$\Rightarrow$ Area $\Delta BCF = \frac{1}{2}$ Ar ΔACE ½

OR

Let $\Delta ABC \sim \Delta PQR$

$\therefore \frac{\text{ar}\,\Delta ABC}{\text{ar}\,\Delta PQR} = \frac{AB^2}{PQ^2} = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2}$ 1

Given arΔABC = arΔPQR

$\Rightarrow \frac{AB^2}{PQ^2} = 1 = \frac{BC^2}{QR^2} = \frac{AC^2}{PR^2}$ 1

$\Rightarrow AB = PQ, BC = QR, AC = PR$

$\Rightarrow$ Therefore $\Delta ABC \cong \Delta PQR$ (SSS congruence rule) 1

18. Let the usual speed of the plane be x km/hr

$\therefore \frac{1500}{x} - \frac{1500}{x+100} = \frac{30}{60}$ 1

$\Rightarrow x^2 + 100x - 300000 = 0$

$\Rightarrow x^2 + 600x - 500x - 300000 = 0$

$\Rightarrow (x + 600)(x - 500) = 0$ 1

$x \neq -600$, ½

$\therefore x = 500$

Speed of plane = 500 km/hr ½

19.

Salary (In thousand ₹)	No. of Persons (f)	cf
5 – 10	49	49
10 – 15	133	182
15 – 20	63	245
20 – 25	15	260
25 – 30	6	266
30 – 35	7	273
35 – 40	4	277
40 – 45	2	279
45 – 50	1	280

$\frac{N}{2} = \frac{280}{2} = 140$ 1

Median class is 10–15 1

Median $= l + \frac{h}{f}\left(\frac{N}{2} - C\right)$

$= 10 + \frac{5}{133}(140 - 49)$

$= 10 + \frac{5 \times 91}{133}$

$= 13.42$ 1

Median salary is ₹ 13.42 thousand or ₹ 13420 (approx.)

20. Total surface areas of article = CSA of cylinder + CSA of 2 hemispheres

CSA of cylinder = $2\pi rh$

$= 2 \times \frac{22}{7} \times 3.5 \times 10$

$= 220\ cm^2$ 1

Surface area of two hemispherical scoops $= 4 \times \frac{22}{7} \times 3.5 \times 3.5$

$= 154 cm^2$ 1

Total surface Area of article $= 220 + 154$

$= 374\ cm^2$ 1

OR

Radius of conical heap = 12m ½

Volume of rice $= \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 3.5 m^2$

$= 528 m^3$ 1

Area of canvas cloth required = πrl

$l = \sqrt{12^2 + (3.5)^2} = 12.5m$ ½

$\therefore$ Area of canvas required $= \frac{22}{7} \times 12 \times 12.5 = 471.4 m^2$ 1

21. Radius of each arc drawn = 6 cm

Area of one quadrant $= (3.14) \times \frac{36}{4}$ ½

Areas of four quadrants $= 3.14 \times 36 = 113.04\ cm^2$ 1

Areas of square ABCD = $12 \times 12 = 144$ cm^2 1

Hence area of shaded region = $144 - 113.04$ 1

$= 30.96$ cm^2 ½

22. $4 \tan \theta = 3$

$\Rightarrow \tan\theta = \frac{3}{4}$

$\Rightarrow \sin\theta = \frac{3}{5}$ and $\cos\theta = \frac{4}{5}$ ½ + ½

$\therefore \frac{4\sin\theta - \cos\theta + 1}{4\sin\theta + \cos\theta - 1} = \frac{4\times\frac{3}{5} - \frac{4}{5} + 1}{4\times\frac{3}{5} + \frac{4}{5} - 1}$

$= \frac{13}{11}$ 1

$\Rightarrow \tan 2A = \cot (A = 18°)$

$\Rightarrow \tan 2A = \tan [90° - (A\ 18°)]$ 1

$\Rightarrow 2A = 90° - (A\ 18°)$

$\Rightarrow 3A = 108°$ 1

$\Rightarrow A = 36°$

SECTION D

23. Let AB be the tower and ships are at points C and D.

$\tan 45° = \frac{AB}{BC}$

$\Rightarrow \frac{AB}{BC} = 1$

$\Rightarrow AB = BC$ 1

Also $\tan 30° = \frac{1}{\sqrt{3}} = \frac{AB}{BC + CD}$ 1

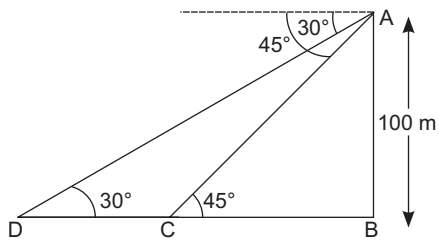
$\Rightarrow \frac{1}{\sqrt{3}} = \frac{AB}{AB + CD}$ 1

$\Rightarrow AB + CD = \sqrt{3}\ AB$

$\Rightarrow CD = AB(\sqrt{3} - 1)$

$= 100 \times (1.732 - 1)$

$= 73.2$m 1



24. Here $r_1 = 15$cm, $r_2 = 5$cm and h = 24 cm

(i) Area of metal sheet = CSA of the bucket + area of lower end

$= \pi l(r_1 + r_2) + \pi r_2^2$ 1

where $l = \sqrt{24^2 + (15-5)^2} = 26$ cm 1

$\therefore$ Surface area of metal sheet = $3.14(26 \times 20 + 25)$cm^2

$= 1711.3$ cm^2 1

(ii) We should avoid use of plastic because it is non-degradable of similar value. 1

25. LHS = $\frac{\sin A - 2\sin^2 A}{2\cos^2 A - \cos A}$

$= \frac{\sin A(1 - 2\sin^2 A)}{\cos A(2\cos^2 A - 1)}$ 1

$= \dfrac{\sin A(1-2(1-\cos^2 A))}{\cos A(2\cos^2 A-1)}$ 1

$= \tan A \dfrac{(2\cos^2 A-1)}{(2\cos^2 A-1)}$ 1

$= \tan A = \text{R.H.S}$ 1

26.

Class	x	f	fx	
11–13	12	3	36	
13–15	14	6	84	½
15–17	16	9	144	½
17–19	18	13	234	1
19–21	20	f	$20f$	
21–23	22	5	110	
23–25	24	4	96	
		$\Sigma f = 40 + f$	$\Sigma fx = 704 + 20f$	1

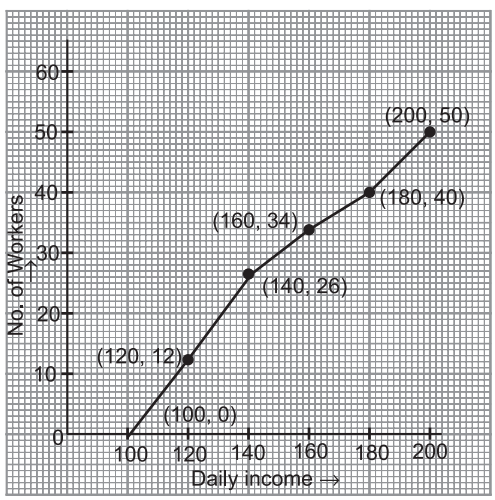
$$\text{Mean} = \frac{\Sigma fx}{\Sigma f}$$

$$\Rightarrow \quad 18 = \frac{704+20f}{40+f} \quad \Rightarrow 720 + 18f = 704 + 20f \quad \Rightarrow f = 8$$

OR

Cumulative frequency distributions table of less than type is

Daily income	f	Cumulative frequency
Less than 100	0	0
Less than 120	12	12
Less than 140	14	26
Less than 160	8	34
Less than 180	6	40
Less than 200	10	50



27. Let the speed of stream be x km/hr.

$\therefore$ The speed of the boat upstream $= (18 - x)$ km/hr
and speed of the boat downstream $= (18 + x)$ km/hr — 1

As given in the equation,

$$\frac{24}{18-x} - \frac{24}{18+x} = 1 \qquad 1$$

$\Rightarrow x^2 + 48x - 324 = 0$ ½

$\Rightarrow (x + 54)(x - 6) = 0$

$x \neq -54$, 1

$\therefore\ x = 6$

$\therefore$ speed of the stream = 6km/hr. ½

OR

Let the original average speed of train be x km/hr.

Therefore $\frac{63}{x} + \frac{72}{x+6} = 3$ 1½

$\Rightarrow\ x^2 - 39x - 126 = 0$ 1

$\Rightarrow\ (x - 42)(x + 3) = 0$

$x \neq -3\ \ \therefore\ x = 42$ 1

Original speed of train is 42 km/hr.

28. Let the four consecutive terms of the AP, be $a - 3d,\ a - d,\ a + d,\ a + 3d$ ½

By given conditions,

$(a - 3d) + (a - d) + (a + d) + (a + 3d) = 32$

$\Rightarrow\ 4a = 32$

$\Rightarrow\ a = 8$

and $\frac{(a-3d)(a+3d)}{(a-d)(a+d)} = \frac{7}{15}$ 1

$\Rightarrow\ 8a^2 = 128d^2$ 1

$\Rightarrow\ d^2 = 4$ ½

$\Rightarrow\ d = \pm 2$ 1

$\therefore$ Numbers are 2, 6, 10, 14 or 14, 10, 6, 2. 1

29. Correct Construction of Δ ABC 2

Correct construction of similar to ΔABC 2

30. Draw AE $\perp$ BC

$\Delta AEB \cong \Delta AEC$ (R.H.S. congruence rule)

$\therefore$ BE = EC = $\frac{1}{2}$BC = $\frac{1}{2}$AB

Let AB = BC = AC = x 1

Now BE = $\frac{x}{2}$ and DE = BE – BD

$= \frac{x}{2} - \frac{x}{3} = \frac{x}{6}$ 1

Now $AB^2 = AE^2 + BE^2$ …(1) 1

and $AD^2 = AE^2 + DE^2$ …(2)

From (1) and (2)

$AB^2 - AD^2 = BE^2 - DE^2$

$\Rightarrow x^2 - AD^2 = \left(\frac{x}{2}\right)^2 - \left(\frac{x}{6}\right)^2$

$\Rightarrow AD^2 = x^2 - \frac{x^2}{4} + \frac{x^2}{36}$ 1

$\Rightarrow AD^2 = \frac{28}{36}x^2$

$\Rightarrow 9AD^2 = 7AB^2$

OR

Given, to Prove, Construction and Figure ½ × 4 = 2

Correct Proof 2