Mathematics

Sample Question Paper 2 Solutions
(Class 10) (Term – 1) (Session 2021-22)
SECTION – A

Section - A consists of 20 questions of 1 mark each.

1. ANSWER: (A)
Required largest number = HCF of (70 – 5) and (125 – 8) = HCF of 65 and 117 = 13.

2. ANSWER: (C)
Since $p = ab^2 = a \times b \times b$
And $q = a^3b = a \times a \times a \times b$
Thus, LCM of p and q = $a \times a \times a \times b \times b = a^3b^2$

3. ANSWER: (A)
Let $f(x) = x^3 + ax^2 + bx + c$ or, one of the zeroes of f (x) is –1 so, f(–1) = 0.
$\Rightarrow (-1)^3 + a(-1)^2 + b(-1) + c = 0 \Rightarrow -1 + a - b + c = 0$
$\Rightarrow a - b + c = 1 \Rightarrow c = 1 + b - a$
Now, $\alpha \beta \gamma = -d/a$ [a = 1, d = c]
$-1 \beta \gamma = -c/1 \Rightarrow \beta \gamma = c \Rightarrow \beta \gamma = 1 + b - a$

4. ANSWER: (B)
Let given quadratic polynomial be
$P(x) = x^2 + 99x + 127$
On comparing p(x) with $ax^2 + bx + c$. we get a = 1, b = 99 and c = 127

We know that, $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ [By quadratic formula]

$$\Rightarrow x = \frac{-99 \pm \sqrt{(99)^2 - 4 \times 1 \times 127}}{2 \times 1} = \frac{-99 \pm \sqrt{9801 - 508}}{2} = \frac{-99 \pm \sqrt{9293}}{2} = \frac{-99 \pm 96.4}{2}$$

$$\Rightarrow x = \frac{-99 + 96.4}{2} \text{ or } x = \frac{-99 - 96.4}{2}$$

$\Rightarrow x = -1.3$ or $x = -97.7$
Hence, both the zeroes of quadratic equation are negative.

5. ANSWER: (A)
Let $f(x) = x^2 + kx + k, k \neq 0$.
On comparing the given polynomial with $ax^2 + bx + c$, we get a=1, b=k, c=k
If α and β be the zeroes of the polynomial (x).
We know that, Sum of zeroes, $\alpha + \beta = -b/a$
$\alpha + \beta = -k/1 = -k$ ...(i)
and product of zeroes, $\alpha \beta = c/a$
$\alpha \beta = k/1 = k$ ...(ii)
Case 1: If k is negative, α β [from equation (ii)] is negative. It means α and β are of opposite sign.
Case 2: If k is positive, then α β [from equation (ii)] is positive but α + β is negative. If, the product of two numbers is positive, then either both are negative or both are positive. But the sum of these numbers is negative, so numbers must be negative. Hence, in any case zeroes of the given quadratic polynomial cannot both be positive.

6. ANSWER: (D)
Here, $a_1/a_2 = 1/-3 = -1/3$,
$b_1/b_2 = -1/3$,
$c_1/c_2 = 5/1$
$a_1/a_2 = b_1/b_2 \neq c_1/c_2$
So, the system of linear equations has no solution.

7. ANSWER: (C)
Condition for consistency:
$a_1/a_2 \neq b_1/b_2$ has unique solution (consistent), i.e. , intersecting at one point
or $a_1/a_2 = b_1/b_2 = c_1/c_2$
(Consistent lines, coincident or dependent)

8. ANSWER: (C)
$3x - y = -18$ ...(i)
$6x - ky = -16$ ...(ii)
For coincident lines,
$a_1/a_2 = b_1/b_2 = c_1/c_2$
or, $3/6 = -1/-k = -8/-16$ or, $1/2 = 1/k = 1/2$
So, $k = 2$

9. ANSWER: [B]
Let X(−4, 0), Y(4, 0) and Z(0, 3) are the vertices.

Now, $XY = \sqrt{\left[4-(-4)\right]^2 + (0-0)^2} = \sqrt{8^2} = 8$

$YZ = \sqrt{[0-4]^2 + (3-0)^2} = \sqrt{16+9} = 5$

$ZX = \sqrt{\left[0-(-4)\right]^2 + (3-0)^2} = \sqrt{16+9} = 5$

Here, YZ = ZX, therefore the triangle XYZ is an isosceles triangle.

10. ANSWER: (B)
In ΔDEF and ΔPQR, ∠D=∠Q and ∠R=∠E.
By AA similarity, we get ΔDEF ∼ ΔQRP. Hence, DE/QR= EF/RP=DF/QP.

11. ANSWER: (B)
In ΔABC and ΔDEF, ∠DEF, ∠B=∠E and ∠F=∠C.
By AA similarity, we get ΔABC ∼ ΔDEF. Thus, the triangles are similar but not congruent.

12. ANSWER: (B)
Given expression,
$\sin^2 22° + \sin^2 68° / \cos^2 22° + \cos^2 68° + \sin^2 63° + \cos 63° \sin 27°$
$= \sin^2 22° + \sin^2 (90°-22°) / \cos^2 (90°-68°) + \cos^2 68° + \sin^2 63° + \cos 63° \sin (90°-63°)$
$= \sin^2 22° + \cos^2 22° / \cos^2 68° + \sin^2 68° + \sin^2 63° + \cos 63°. \cos 63°$
[$\sin (90°- \theta) = \cos \theta$ and $\cos (90°- \theta) = \sin \theta$]
$= 1/1 + (\sin^2 63° + \cos 63°)$ [$\sin^2 \theta + \cos^2 \theta$] $= 1 + 1 = 2$

13. ANSWER: (B)
Given: 4 tan θ = 3 or, tan θ =3/4

$$\frac{4\sin\theta - \cos\theta}{4\sin\theta + \cos\theta}$$

[Divided by cos θ in both numerator and denominator]

$$\frac{4\tan\theta - 1}{4\tan\theta + 1} = \frac{4\left(\frac{3}{4}\right) - 1}{4\left(\frac{3}{4}\right) + 1} = \frac{3-1}{3+1} = \frac{2}{4} = \frac{1}{2}$$

14. ANSWER: (B)

Given, $\cos A = \frac{4}{5}$

Therefore, $\sin A = \sqrt{1-\cos^2 A} = \sqrt{1-\left(\frac{4}{5}\right)^2} = \sqrt{1-\frac{16}{25}} = \sqrt{\frac{25-16}{25}} = \sqrt{\frac{9}{25}} = \frac{3}{5}$

Now, $\tan A = \frac{\sin A}{\cos A} = \frac{3/5}{4/5} = \frac{3}{4}$

15. ANSWER: (A)
Given, sin A = 1/2

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

$\cos A = \sqrt{1-\frac{1}{4}} = \sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{2}$ $\left[\because \cos A = \sqrt{1-\sin^2 A}\right]$

Now, $\cot A = \frac{\cos A}{\sin A} = \frac{\frac{\sqrt{3}}{2}}{\frac{1}{2}} = \sqrt{3}$

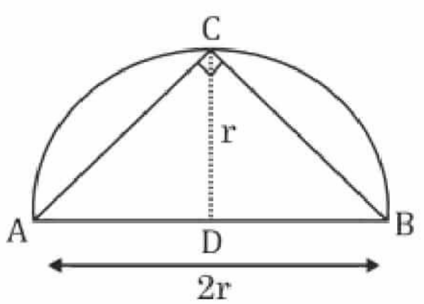
16. ANSWER: (C)

Explanation Given, sin $\theta = \frac{a}{b}$

$\left[\because \cos\theta = \sqrt{1-\sin^2\theta}\right]$

Therefore, $\cos\theta = \sqrt{1-\left(\frac{a}{b}\right)^2} = \sqrt{1-\frac{a^2}{b^2}} = \frac{b^2-a^2}{b}$

17. ANSWER: (A)
Take a point C on the circumference of the semi-circle and join it by the end points of diameter AB.



∠C = 90° [Angle in a semi-circle is right angle]

So ΔABC = $\frac{1}{2}$ x AB x CD = $\frac{1}{2}$ x2r x r=r^2 square units.

18. ANSWER: (B)
Let the radius of circle be 'r' and side of square be 'a'.
According to given question,
Perimeter of circle= perimeter of square

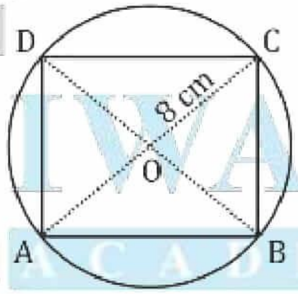
$2 \pi r = 4a$ or $a = \frac{\pi r}{2}$ ...(i)

So, $\frac{\text{Area of circle}}{\text{Area of square}} = \frac{\pi r^2}{(\pi r/2)^2}$ [From equation (i)]

Solving equation (i), we get result as $\frac{14}{11}$.

19. ANSWER: (A)
Area of first Circular Park whose diameter is 16m,
$= \pi (16/2)^2 = \pi (8)^2 = 64\pi\ m^2$
Area of second Circular Park whose diameter is 12m,
$= \pi (12/2)^2 = = \pi(6)^2 = 36\pi\ m^2$
According to question, Area of single Circular Park
= Area of first circular park+ Area of second Circular Park
$\pi r^2 = 64\pi + 36\pi$
$\Rightarrow \pi r^2 = 100\ \pi$ $\Rightarrow r^2 = 10m$

20. ANSWER: (B)
Given, radius of circle, r = OC = 8
Diameter of the circle = AC = 2 x OC = 2 x 8 = 16 cm
Which is equal to the diagonal of a square.



Let side of square be 'a'
Using Pythagoras theorem, $AB^2 + BC^2 = AC^2$
$\Rightarrow a^2 + a^2 = 16^2$ $\Rightarrow 2a^2 = 256$ $\Rightarrow a^2 = 128\ cm^2$

SECTION – B

Section - B consists of 20 questions of 1 mark each.

21. ANSWER: (C)
Probability of an event + Probability of its complementary event = 1
Or, p + Probability of complement = 1
Probability of complement = 1 – p

22. ANSWER: (B)
Probability lies between 0 and 1 and when it is converted into percentage it will be between 0 and 100. So, cannot be negative.

23. ANSWER: (A)
In a deck of 52 cards, there are 26 red cards.
Number of red face cards = 3 of hearts +3 of diamonds = 6
So, Probability of having a red face card = 6/52 = 3/26.

24. ANSWER: (A)
The product of a non-zero rational with and an irrational number is always irrational.

25. ANSWER: (B)
We have, 1.732 = 1732/1000 = 433/250
Which is a rational number.

26. ANSWER: (C)
Given number is non-terminating, non-repeating decimal. So, it is an irrational number.

27. ANSWER: (D)
$$\frac{14587}{1250}=\frac{14587}{2\times5^4}=\frac{14587}{2\times5^4}\times\frac{2^3}{2^3}=\frac{14587\times2^3}{(2\times5)^4}=\frac{116696}{10000}=11.6696$$
Thus, the given rational number terminates after four decimal places.

28. ANSWER: (D)
Graph (D) intersect at three points on x-axis so the roots of polynomial of graph is three, so it is cubic polynomial. Other graphs are of quadratic polynomial. Graph a have no real zeroes and Graph b has coincident zeroes.

29. ANSWER: (D)
$a^1/a^2 = b^1/b^2 = c^1/c^2 = 1/k$ ...(i)
Given equation of line is, $-5x + 7y - 2 = 0$
Here, $a^1 = -5$, $b^1 = 7$, $c^1 = -2$
From Equation (i), $-5/a^2 = 7/b^2 = -2/c^2 = 1/k$
or, $a^2 = -5k$, $b^2 = 7k$, $c^2 = -2k$
Where, k is any arbitrary constant.
Putting k = 2, then $a^2 = -10$, $b^2 = 14$ and $c^2 = -4$
Or, the required equation of line becomes, $a^2x + b^2y + c^2 = 0$
or, $10x + 14y - 4 = 0$
or, $10x - 14y + 4 = 0$

30. ANSWER: (C)
For parallel lines (or no solution)
$a^1/a^2 = b^1/b^2 \neq c^1/c^2$ $\Rightarrow 3/2 = 2k/5 \neq -2/1$ $\Rightarrow 4k = 15$ or, $k = 15/4$

31. ANSWER: (A)
Let one angle be x. Then, other angle (its supplementary angle) = (180° – x)
Given, $x+18°=180°-x$ $\Rightarrow 2x = 180° - 18°$ $\Rightarrow 2x = 162°$ $\Rightarrow x = 81°$
Now, the other angle=180° – 81° = 99°
Hence, two required angles are 81° and 99°.

32. ANSWER: (B)

$9\sec^2 A - \tan^2 A = 9(\sec^2 A - \tan^2 A) = 9(1)$ $[\sec^2 A - \tan^2 A = 1]$

$= 9$

33. ANSWER: (C)

$(1+ \tan \theta + \sec \theta)(1+\cot \theta - \text{cosec } \theta)$

$$=\left(1+\frac{\sin\theta}{\cos\theta}+\frac{1}{\cos\theta}\right)\left(1+\frac{\cos\theta}{\sin\theta}-\frac{1}{\sin\theta}\right) = \left(\frac{\cos\theta+\sin\theta+1}{\cos\theta}\right)\left(\frac{\cos\theta+\sin\theta-1}{\sin\theta}\right)$$

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

34. ANSWER: (D)

$(\sec A + \tan A)(1 - \sin A)$

$$=\left(\frac{1}{\cos A}+\frac{\sin A}{\cos A}\right)(1-\sin A)=\frac{(1+\sin A)}{\cos A}\times\frac{(1-\sin A)}{1}=\frac{1-\sin^2 A}{\cos A}=\frac{\cos^2 A}{\cos A}=\cos A$$

35. ANSWER: (C)

As the probability of an event lies between 0 and 1.

36. ANSWER: (A)

Number of days is non-leap year = 365

Number of weeks = 365/7 weeks = 52 weeks and 1 day

Number of days left = 1

For example, it may be any of 7 days which from Sunday, Monday, Tuesday, Wednesday, Thursday, Friday and Saturday;

So, T(E)=7 and F(E)=1(Sunday)

P(F) = F(E)/T(E) = 1/7

37. ANSWER: (D)

Let the number of ₹ 1 coins = x and the number of ₹ 2 coins = y

So, according to the question,

$x + y = 50$ ...(i)

$x + 2y = 75$ ...(ii)

Subtracting equation (i) from (ii), y = 25

Subtracting value of y in (i), x = 25

So, y = 25 and x = 25

38. ANSWER: (B)

Given,

$2x + y = 23$ ...(i)

And $4x - y = 19$ ...(ii)

On, adding equation (i) and (ii), we get, 6x = 42 or, x = 7

Putting the value of x in equation (i), we get, 14 + y = 23 or y = 23 – 14 = 9

Hence, 5y – 2x = 5 x 9 - 2 x 7 = 45 – 14 = 31

and y/x – 2 = 9/7 – 2 = (9 – 14)/7 = – 5/7

39. ANSWER: (C)

$$\frac{1}{\sqrt{2}}=\frac{1}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}=\frac{\sqrt{2}}{2}$$

Hence, $\sqrt{2}$ is irrational, so $\frac{\sqrt{2}}{2}$ is also an irrational number.

40. ANSWER: (C)

The sum of rational numbers = $\frac{15}{4}+\frac{5}{40}=\frac{150+5}{40}=\frac{155}{40}=\frac{31}{8}=\frac{31}{2^3}$

So, it will terminate after 3 decimal places.

SECTION – C

Section - C consists of 10 questions of 1 mark each.

Case Study – 1

41. ANSWER: (A)

No. of rose plants = 135

No. of marigold plants = 225

The maximum number columns in which they can be planted of = HCF of 135 and 225

Or, Prime factors of 135 = 3 x3 x 3 x 5

And 225 = 3 x 3 x 5 x 5

Or, Prime factors of 135 = 3 x 3 x 5 = 45

42. ANSWER: (C)

Total number of plants 135 + 225 = 360 plants

43. ANSWER: (B)

We have proved that the maximum number columns = 45

So, Prime factors of 45= 3 x 3 x 5 = 3^2 x 5^1

or, Sum of exponents = 2 + 1 = 3

44. ANSWER: (C)

Number of rows of Rose plants = 135/45 = 3

Number of rows of marigold plants = 225/45 = 5

Total number of rows = 3 + 5 = 8

45. ANSWER: (D)

Total number of plants = 135 + 225 = 360

The prime factors of 360 = 2 x 2 x 2 x 3 x 3 x 5 = 2^3 x 3^2 x 5^1

Or, sum of exponents = 3 + 2 + 1 = 6

Case Study - 2

46. ANSWER: (B)

Explanation: $x^2 - 2x - 8 = 0$

Or, $x^2 - 4x + 2x - 8 = 0$ or $x(x - 4) + 2(x - 4) = 0$

Or, $(x - 4)(x + 2) = 0$ or $x = 4, x = -2$

47. ANSWER: (A)

We know that the number of zeroes of polynomial is equal to number of points where the graph of polynomial intersects X-axis.

48. ANSWER: (C)

Explanation: Here, the given graph of a quadratic polynomial is a parabola.

49. ANSWER: (B)

$x^2 - 36 = 0$

$\Rightarrow x^2 = 36$

$\Rightarrow x = \pm \sqrt{36}$

$\Rightarrow x = 6, -6$

50. ANSWER: (C)

We have, $f(x) = (x - 2)^2 + 4$

$= x^2 + 4 - 4x + 4$

$= x^2 - 4x + 8$

Now $D = b^2 - 4ac = (-4)^2 - 4 \times 1 \times 8 = 16 - 32 = -16$

$D < 0$, so it has no real roots.

Hence no real value of x is possible, i.e., no zero.