CBSE Class 10 Mathematics Basic Solution 2024 (Set 1 - 430/1/1)

Ques 1. For what value of k, the product of zeroes of the polynomial $kx^2 - 4x - 7$ is 2
(a) - 1/14
(b) - 7/2
(c) 7/2
(d) - 2/7

Solu. We are given the quadratic equation: kx^2 - 4x - 7 = 0 (notice the coefficient of x^2 is k)
We want to find k such that the product of the roots (x1 and x2) is 2.
Step 1: Relate Product of Roots and Coefficients
We know from the quadratic formula that the roots of the equation are:
x1, x2 = (-b ± √(b^2 - 4ac)) / (2a)
In our case, a = k, b = -4, and c = -7. The product of the roots (x1 * x2) is given by:
x1 * x2 = c / a = -7 / k
Step 2: Set Up the Equation
Since we want the product of the roots to be 2, we can write the equation:
-7 / k = 2
Step 3: Solve for k
To isolate k, multiply both sides by k:
k * (-7 / k) = 2 * k
Simplify:
-7 = 2k
Divide both sides by 2:
-7 / 2 = k
Therefore, the value of k that satisfies the condition is k = -7/2.

Ques 2. In an A.P., if a = 8 and a_{10} = - 19 then value of d is:
(a) 3
(b) - 11/9
(c)- 27/10
(d) - 3

Solu. The value of d in this arithmetic progression (A.P.) is -3.
Here's how we can find it:
We know two things about the A.P.:

1. The first term (a) is 8.
2. The tenth term (a_{10}) is -19.

We want to find the common difference (d) between consecutive terms.
Formula for nth term in A.P.:
The general formula for the nth term in an A.P. is:
$a_n = a + (n - 1) * d$
where:

- a_n is the nth term
- a is the first term
- n is the term number
- d is the common difference

Applying the formula to the 10th term:
We are given that $a_{10} = -19$ (the tenth term) and a = 8 (the first term). We can plug these values into the formula:
$a_{10} = a + (10 - 1) * d$
$-19 = 8 + (9) * d$
Solving for d:
To isolate d, we can rearrange the equation:
$d = (a_{10} - a) / (n - 1)$
$d = (-19 - 8) / (10 - 1)$
$d = -27 / 9$
Simplifying:
$d = -3$
Answer:
Therefore, the common difference (d) in this A.P. is -3. The correct answer is (d) -3.

Ques 3. The mid-point of the line segment joining the points (- 1, 3) and (8,3/2) is:
A. (7/2, - 3/4)
B. (7/2, 9/2)
C. (9/2, - 3/4)
D. (7/2, 9/4)

Solu. Let's find the midpoint of the line segment joining the points (-1, 3) and (8, 3/2).
Formula for Midpoint:
The midpoint of a line segment joining points (x1, y1) and (x2, y2) is given by:
Midpoint coordinates = ((x1 + x2) / 2, (y1 + y2) / 2)
Applying the formula:
In this case, (x1, y1) = (-1, 3) and (x2, y2) = (8, 3/2). Let's find the midpoint coordinates:
Midpoint x-coordinate = ((-1 + 8) / 2) = (7 / 2) Midpoint y-coordinate = ((3 + 3/2) / 2) = (9/4)
Therefore, the midpoint of the line segment is (7/2, 9/4).
Answer:
The correct answer is (D) (7/2, 9/4).

Ques 4. If sin theta = 1/3 then sec theta is equal to
(a) (2sqrt(2))/3
(b) 3/(2sqrt(2))
(c) 3
(d) 1/(sqrt(3))

Solu. Given that sin(theta) = 1/3
We know that sec(theta) = 1/cos(theta)
Using the Pythagorean identity sin^2(theta) + cos^2(theta) = 1
We can find cos(theta)
sin^2(theta) + cos^2(theta) = 1;
(1/3)^2 + cos^2(theta) = 1;

1/9 + cos^2(theta) = 1;
cos^2(theta) = 1 - 1/9 = 8/9;
Taking the square root of both sides gives us cos(theta) = ±(2√2)/3
Since theta is in the first quadrant, cos(theta) is positive
cos(theta) = 2√2/3;
Therefore, sec(theta) = 1/cos(theta) = 3/(2√2)
So, the correct option is:
(b) 3/(2√2)

Ques 5. HCF (132, 77) is:
(a) 11
(b) 77
(c) 22
(d) 44

Solu. The HCF (highest common factor) of 132 and 77 is 11.
Here's how we can find it:

1. Prime Factorization: We can prime factorize both numbers:

132 = 2 * 2 * 3 * 11 77 = 7 * 11

2. Identify Common Factors: The common factors that appear in both prime factorizations are: 11
3. Greatest Common Factor: The HCF is the largest of these common factors.

Therefore, HCF(132, 77) = 11.
So the answer is (a) 11.

Ques 6. If the roots of quadratic equation 4x ^ 2 - 5x + k = 0 are real and equal, then value of k is:

Solu. The condition for a quadratic equation to have real and equal roots is for the discriminant (b^2 - 4ac) to be equal to zero.
In this case:

- a = 4
- b = -5
- c = k

Therefore, for real and equal roots:
$(-5)^2 - 4 * 4 * k = 0$ $25 - 16k = 0$ $16k = 25$ $k = 25/16$
So the value of k for real and equal roots is $k = 25/16$.

Ques 7. If probability of winning a game is p, then probability of losing the game is

Solu. If the probability of winning a game is p, then the probability of losing the game is: $1 - p$
This is because winning and losing are complementary events. They are mutually exclusive (you can't win and lose the same game) and exhaustive (one or the other must happen). The sum of the probabilities of complementary events is always 1.

Ques 8. The distance between the points (2,-3) and (-2, 3) is:
(a) $2\sqrt{13}$ units (b) 5 units (c) $13\sqrt{2}$ units (d) 10 units

Solu. To determine the distance between the points (2, -3) and (-2, 3), we use the distance formula:
$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Here, $(x_1, y_1) = (2, -3)$ and $(x_2, y_2) = (-2, 3)$.
First, calculate the differences in the coordinates:
$x_2 - x_1 = -2 - 2 = -4$
$y_2 - y_1 = 3 - (-3) = 3 + 3 = 6$
Now, square these differences
$(-4)^2 = 16$
$6^2 = 36$
Add these squared differences:
$16 + 36 = 52$
Finally, take the square root to find the distance:
$d = \sqrt{52} = \sqrt{4 \cdot 13} = 2\sqrt{13}$
So, the distance between the points (2, -3) and (-2, 3) is $2\sqrt{13}$ units.
Therefore, the correct answer is:
(a) $2\sqrt{13}$ units

Ques 9. For what value of θ, $\sin^2\theta+\sin\theta+\cos^2\theta$ is equal to 2?

Solu. The expression $\sin^2\theta + \cos^2\theta$ is always equal to 1 for any value of θ. This is a fundamental trigonometric identity.
We can use this identity to simplify the given equation:
$\sin^2\theta + \sin\theta + \cos^2\theta = 2$
(based on the identity) $1 + \sin\theta = 2$
Subtracting 1 from both sides:
$\sin\theta = 1$
However, sinθ can only be 1 when the angle θ is 90 degrees (π/2 radians) or some multiple of 360 degrees + 90 degrees (which is equivalent to adding multiples of 2π radians).
Therefore, for any value of θ that satisfies $\sin\theta = 1$, the equation $\sin^2\theta + \sin\theta + \cos^2\theta$ will be equal to 2. This includes angles like:

- $\theta = 90°$ (π/2 radians)
- $\theta = 450°$ (5π/2 radians)
- $\theta = -270°$ (-3π/2 radians)

and so on.
So, Correct option is C) 90^0

Ques 10. A card is drawn from a well shuffled deck of 52 playing cards. The probability that drawn card is a red queen, is:

Solu. There are two red queens (Hearts and Diamonds) in a well-shuffled deck of 52 cards. So, the probability of drawing a red queen is:
Favorable outcomes (drawing a red queen) / Total number of outcomes (drawing any card)
Favorable outcomes = 2 (red queens) Total outcomes = 52 (total cards)
Probability = 2 / 52
Simplifying the fraction, we get:
Probability = 1/26
Therefore, the probability of drawing a red queen is option (d) 1/26.

Ques 11. If a certain variable x divides a statistical data arranged in order into two equal parts, then the value of x is called the :

(d) range
(b) median
(c) mode
(a) mean
of the data.

Solu. The variable x that divides a statistical data arranged in order into two equal parts is called the (b) median of the data.
The median refers to the middle value when the data is ordered from least to greatest. It represents the point at which half of the data falls below and the other half falls above.

Ques 12. The radius of a sphere is 7/2 cm. The volume of the sphere is :
(a) 231/3 cu cm
(b) 539/12 cu cm
(c) 539/3 cu cm
(d) 154 cu cm

Solu. To find the volume of the sphere with a given radius, we use the formula for the volume of a sphere:
V = frac{4}{3} pi r^3
Given:
r = frac{7}{2} { cm}
First, calculate (r^3):
r^3 = left(frac{7}{2}right)^3 = frac{7^3}{2^3} = frac{343}{8}
Next, substitute (r^3) into the volume formula:
V = frac{4}{3} pi left(frac{343}{8}right)
V = frac{4 cdot 343 pi}{3 cdot 8}
V = frac{1372 pi}{24}
V = frac{343 pi}{6}
To find the exact volume, we approximate pi) as frac{22}{7}):
V = frac{343 times frac{22}{7}}{6}
V = frac{343 times 22}{7 times 6}
V = frac{343 times 22}{42}

V = frac{343 times 11}{21}
V = frac{3773}{21}
This simplifies to:
V = 179.67 { cubic centimeters}
However, none of the given answer choices seem to exactly match this.
Let's verify the options with calculations:
1. frac{231}{3} approx 77 { cubic centimeters})
2. frac{539}{12} approx 44.92 { cubic centimeters})
3. frac{539}{3} approx 179.67 { cubic centimeters})
4. (154 { cubic centimeters})
The correct answer that closely matches our calculated volume is:
(c) frac{539}{3} { cubic centimeters})
Thus, the correct option is:
(c) 539/3 cu cm

Ques 13. The mean and median of a statistical data are 21 and 23 respectively. The mode of the data is :
(a) 27
(b) 22
(c) 17
(d) 23

Solu. To determine the mode of the data given the mean and median, we can use the empirical relationship between the mean, median, and mode in a moderately skewed distribution:
{Mode} = 3 * {Median} - 2 * {Mean}
Given:
- Mean (μ) = 21
- Median (M) = 23
We can plug these values into the formula:
1. Calculate 3 * {Median} *:
3 * 23 = 69
2. Calculate * 2 * {Mean} *:
2 * 21 = 42
3. Subtract the second result from the first:

69 - 42 = 27
Therefore, the mode of the data is:
{Mode} = 27
Thus, the mode of the data is: (a) 27

Ques 14. The height and radius of a right circular cone are 24 cm and 7 cm respectively. The slant height of the cone is:
(a) 24 cm
(b) 31 cm
(c) 26 cm
(d) 25 cm

Solu. the slant height of the cone with a single step using the Pythagorean theorem:
Slant height (s) = $\sqrt{(\text{height}^2 + \text{radius}^2)}$
Plugging in the values:
s = $\sqrt{((24 \text{ cm})^2 + (7 \text{ cm})^2)}$
Without a calculator:

1. Notice that 24^2 (576) is a perfect square (24 x 24).
2. We can rewrite 7^2 (49) as $(24 - 17)^2$ using the square of a difference pattern: $(a + b)^2 = a^2 + 2ab + b^2$ and $(a - b)^2 = a^2 - 2ab + b^2$

Therefore, $s^2 = 576 + (24 - 17)^2 = 576 + 49$
Even without calculating the square root, we can see that s^2 is between 576 and 625. Taking the square root of both sides confirms:
$s \approx \sqrt{(625 \text{ cm}^2)} \approx 25$ cm (rounded to two decimal places)

Ques 16. The diameter of a circle is of length 6 cm. If one end of the diameter is (-4, 0), the other end on x-axis is at:
(a) (0,2)
(b) (6,0)
(c) (2,0)
(d) (4,0)

Solu. We can find the other endpoint on the x-axis using the following steps:

1. Center of the circle: The center of the circle is the midpoint of the diameter. Since one endpoint is (-4, 0), and the diameter has a length of 6 cm, the center coordinates will be:
   Center coordinates = (-4 + (diameter/2), 0) Center coordinates = (-4 + (6/2), 0) Center coordinates = (-1, 0)
2. Movement along x-axis: Since the other endpoint lies on the x-axis and has the same y-coordinate (0) as the center, we only need to find its x-coordinate.
3. Endpoint on x-axis: The diameter goes from left (-4) to right. Since the center is at -1, the other endpoint must be the same distance to the right (diameter/2). Therefore:
   Endpoint x-coordinate = Center x-coordinate + (diameter/2) Endpoint x-coordinate = -1 + (6/2) Endpoint x-coordinate = 1

Therefore, the other endpoint on the x-axis is at: (1, 0)

Ques 22 (A) Following pair of linear equations for x and y algebraically: x + 2y = 9 and y - 2x = 2

Solu. the following pair of linear equations for x and y algebraically using the substitution method:
x + 2y = 9 (equation 1)y - 2x = 2 (equation 2)

1. Solve equation 1 for y:
   Isolate y in equation 1: y = (9 - x) / 2
2. Substitute this expression for y in equation 2:
   Replace y in equation 2 with the expression we just obtained:
   ((9 - x) / 2) - 2x = 2
3. Solve the resulting equation for x:
   - Simplify the equation: (9 - x) - 4x = 4 (multiply both sides by 2 to get rid of the fraction) -5x = -5 x = 1
4. Substitute the value of x back into equation 1 to solve for y:
   Now that we know x = 1, plug it back into the equation we solved for y (equation 1):
   y = (9 - 1) / 2 y = 8 / 2 y = 4

Therefore, the solution for the system of equations is:
x = 1 and y = 4

This method allows us to solve for x and y algebraically.

Ques 23. (B) Show that 11 * 19 * 23 + 3 * 11 is not a prime number

Solu. We can demonstrate that 11 * 19 * 23 + 3 * 11 is not a prime number by factoring out a common factor of 11. Here's how:

1. Identify the common factor: Notice that both 11 * 19 * 23 and 3 * 11 share a common factor of 11.
2. Factor out the common factor:
   We can rewrite the expression as:
   11 * 19 * 23 + 3 * 11 = (11 * 19 * 23) + (3 * 11)
   = 11 * (19 * 23 + 3)
3. Analyze the remaining factors:
   - 11 is a prime number by definition (it has exactly two factors: 1 and 11).
   - (19 * 23 + 3) is greater than 1 (since 19 x 23 is a large positive number, adding 3 will still result in a positive number greater than 1).

Since the expression can be factored into a prime number (11) multiplied by another number greater than 1 (19 * 23 + 3), it satisfies the definition of a composite number.
Therefore, 11 * 19 * 23 + 3 * 11 is not a prime number.

Ques 24. Evaluate: sin A cos B + cos A sin B, if A = 30 deg and B = 45 deg

Solu. The expression sin A cos B + cos A sin B using a trigonometric identity. Here's how:

1. Identity for sum of sine and cosine:
   The expression sin A cos B + cos A sin B has a special identity associated with it:
   sin A cos B + cos A sin B = sin (A + B)
2. Plug in the values:
   We are given A = 30° and B = 45°. Substitute these values into the

identity:
sin (30° + 45°)
3. Evaluate the sum in the parentheses:
Before looking up the sine value, calculate the sum inside the parentheses: 30° + 45° = 75°
4. Find the sine value:
Using a calculator or trigonometric table, find the sine of 75°: sin (75°) ≈ 0.966 (rounded to three decimal places)

Therefore, the value of the expression sin 30° cos 45° + cos 30° sin 45° is approximately 0.966.

Ques 26. Two alarm clocks ring their alarms at regular intervals of 20 minutes and 25 minutes respectively. If they first beep together at 12 noon, at what time will they beep again together next time?

Solu. To find the next time the alarms will beep together, we need to determine the least common multiple (LCM) of 20 minutes and 25 minutes. The LCM represents the smallest time interval after which both alarms will have completed an integer number of cycles.
Here's how to find the LCM:

1. Prime Factorization: Break down 20 and 25 into their prime factors:
20 = 2 * 2 * 5 25 = 5 * 5
2. Identify Highest Powers: Notice that 5 appears to the highest power (2) in 25. Since 20 also has a factor of 5, but only to the power of 1, we need to consider the higher power (2) from 25.
Both numbers have factors of 2, but including the factor of 2 twice (from 25's prime factorization) ensures it completes two cycles for every cycle of 20.
3. LCM: The LCM is the product of the highest powers of each prime factor involved:
LCM = 2 * 2 * 5 * 5 = 100

Therefore, the two alarms will beep together again in 100 minutes from 12 noon.
Expressing the time:

Since 12 noon + 100 minutes is past midday, we need to convert it to a standard time format:

- 100 minutes = 1 hour and 40 minutes

Therefore, the next time the alarms beep together is at 1:40 PM.

Ques 27. The greater of two supplementary angles exceeds the smaller by 18°. Find measures of these two angles.

Solu. Let x be the measure of the smaller angle.
1. Relationship between supplementary angles:
Supplementary angles add up to 180 degrees. Since these are two angles, we can represent this mathematically as:
x + larger angle = 180°
2. Larger angle based on smaller angle:
We are given that the larger angle exceeds the smaller angle by 18 degrees. This can be written as:
larger angle = $x + 18°$
3. Substitute and solve for x:
Now, we can substitute the expression for the larger angle in the equation for supplementary angles:
$x + (x + 18°) = 180°$
Combine like terms:
$2x + 18° = 180°$
Subtract 18° from both sides:
$2x = 162°$
Divide both sides by 2 to isolate x:
$x = 81°$
4. Find the larger angle:
Since x represents the smaller angle, we can find the larger angle using the equation we derived earlier:
larger angle = $x + 18°$
Substitute the value of x (81°):
larger angle = 81° + 18°
larger angle = 99°
Therefore:

- The smaller angle measures 81 degrees.
- The larger angle measures 99 degrees.

Ques 28. Find the co-ordinates of the points of trisection of the line segment joining the points (-2, 2) and (7, -4).

Solu. We can find the coordinates of the trisection points for the line segment joining (-2, 2) and (7, -4) using the following steps:

1. Direction vector:
    - Calculate the difference in x and y coordinates between the two points:
      Change in x (dx) = 7 - (-2) = 9 Change in y (dy) = -4 - 2 = -6
    - This difference represents the vector pointing from the first point (-2, 2) to the second point (7, -4).
2. Trisection ratio:
    - Since we need to find the coordinates of two trisection points, we'll use a ratio of 1/3 for the first trisection and 2/3 for the second trisection (along the vector from the first point).
3. First trisection point:
    - Multiply the direction vector components (dx and dy) by the trisection ratio (1/3):
      Change in x for first trisection = (1/3) * dx = (1/3) * 9 = 3
      Change in y for first trisection = (1/3) * dy = (1/3) * (-6) = -2
    - Add these changes to the coordinates of the first point (-2, 2):
      X-coordinate of first trisection point = -2 + 3 = 1 Y-coordinate of first trisection point = 2 - 2 = 0
4. Second trisection point:
    - Multiply the direction vector components by the second trisection ratio (2/3):
      Change in x for second trisection = (2/3) * dx = (2/3) * 9 = 6
      Change in y for second trisection point = (2/3) * dy = (2/3) * (-6) = -4
    - Add these changes to the coordinates of the first point (-2, 2):
      X-coordinate of second trisection point = -2 + 6 = 4 Y-coordinate of second trisection point = 2 - 4 = -2

Therefore, the coordinates of the trisection points are:

- First trisection point: (1, 0)
- Second trisection point: (4, -2)

Ques 30. 30. (A) A solid is in the form of a cylinder with hemi-spherical ends of same radii. The total height of the solid is 20 cm and the diameter of the cylinder is 14 cm. Find the surface area of the solid.

Solu. Here's a solution for the surface area of the solid using fewer equations and combining some steps:

1. Define variables and givens:
   - r (radius): r = diameter (d) / 2 = 14 cm / 2 = 7 cm (given)
   - h (total height): h = 20 cm (given)
   - SA (total surface area): unknown
2. Hemisphere surface area (each):
   - SA_hemi = $2\pi r^2$ (formula for hemisphere surface area)
3. Cylinder lateral surface area and height:

Since the total height (h) includes the heights of both hemispheres (each with radius r), the height of the cylinder (hcyl) can be expressed as:

   - hcyl = h - 2r (total height minus hemisphere heights)

4. Combine surface area terms:

The total surface area (SA) is the sum of the areas:

   - SA = SA_hemi (top) + SA_hemi (bottom) + SA_lateral + SA_circle (top & bottom)

Substitute the expressions for each area:

   - SA = 2 * $2\pi r^2$ (hemispheres) + $2\pi r$ * hcyl + 2 * πr^2 (top & bottom circles)
   - SA = $4\pi r^2$ + $2\pi r$ * (h - 2r) + $2\pi r^2$ (substitute hcyl)

5. Simplify and solve:
   - SA = $6\pi r^2$ + $2\pi r$ * h - $4\pi r^2$ (combine terms)
   - SA = $2\pi r^2$ + $2\pi r$ * h (shortest form)

6. Final calculation:

Plug the value of r (7 cm) into the equation:

- SA ≈ 2π * 7^2 + 2π * 7 * 20 (h cancels out as its value isn't used here)
- SA ≈ 294π cm^2 (rounded to two decimal places)

This approach uses fewer equations by combining the concepts of cylinder height and surface area calculations. It directly uses the total height (h) in the final step to eliminate the need for a separate equation for hcyl.
