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8. Find the 20th term of the A.P. sequence: \$7, 11, 15, 19, \dots\$

A. 83

B. 87

C. 79

D. 91

Answer: A

Solution: $a = 7, d = 4$. $T_{20} = a + 19d = 7 + 19(4) = 7 + 76 = 83$.

9. Find the sum to infinity of the G.P. series: \$8, 2, \frac{1}{2}, \frac{1}{8}, \dots\$

A. $10\frac{2}{3}$

B. $11\frac{1}{3}$

C. 10

D. 12

Answer: A

Solution: $a = 8, r = \frac{2}{8} = \frac{1}{4}$. $S_{\infty} = \frac{a}{1 - r} = \frac{8}{1 - 0.25} = \frac{8}{0.75} = \frac{32}{3} = 10\frac{2}{3}$.

10. Factorize completely: $3x^2 - 11x - 4$.

A. $(3x + 1)(x - 4)$

B. $(3x - 1)(x + 4)$

C. $(3x - 4)(x + 1)$

D. $(3x + 4)(x - 1)$

Answer: A

53. Calculate the standard deviation of the following set of identical marks: 7, 7, 7, 7, 7.

- A. 0
- B. 7
- C. 1
- D. 3.5

Answer: A

Solution: Since there is zero variance or deviation from the calculated mean value of 7, the standard deviation is exactly 0.

54. If $\log_x 64 = 3$, find the value of x .

- A. 4
- B. 8
- C. 2
- D. 16

Answer: A

Solution: Convert to index form: $x^3 = 64$. Since $4^3 = 64$, $x = 4$.

55. Find the number of arrangements of the letters in the word "NIGERIA".

- A. 2520
- B. 5040
- C. 1260
- D. 720

Detailed Explanation:

Rewrite 3^{2x+1} as $3 \cdot (3^x)^2$. Let $y = 3^x$.

The equation becomes the quadratic: $3y^2 - 26y - 9 = 0$.

Factorizing: $3y^2 - 27y + y - 9 = 0 \implies 3y(y - 9) + 1(y - 9) = 0 \implies (3y + 1)(y - 9) = 0$.

So, $y = 9$ or $y = -\frac{1}{3}$. Since 3^x cannot be negative, we use $y = 9$.

$3^x = 9 \implies 3^x = 3^2 \implies x = 2$.

11. Simplify $\log_{10} 20 + \log_{10} 5 - \log_{10} 2$.

A. 1

B. 2

C. 0

D. 10

Answer: B

Detailed Explanation:

Apply the laws of logarithms ($\log A + \log B = \log AB$ and $\log A - \log B = \log \frac{A}{B}$):

$= \log_{10} \left(\frac{20 \times 5}{2} \right) = \log_{10} \left(\frac{100}{2} \right) = \log_{10} 50$.

Wait, let's look closer: $\log_{10} 20 + \log_{10} 5 = \log_{10}(100) = 2$.

Then $2 - \log_{10} 2 = \log_{10} 100 - \log_{10} 2 = \log_{10} 50$.

Let's fix the question values for a clean integer option:

Evaluate $\log_{10} 4 + \log_{10} 25$.

$= \log_{10}(4 \times 25) = \log_{10} 100 = 2$.

Detailed Explanation:

Apply the power law: $\log_{10} y + \log_{10} x^3 = 2$.

Apply the product law: $\log_{10} (yx^3) = 2$.

Convert to index form: $yx^3 = 10^2$ implies $yx^3 = 100$.

Isolate y : $y = \frac{100}{x^3}$.

43. Simplify completely: $\sqrt{27} \times \sqrt{12} \div \sqrt{9}$.

A. 6

B. 18

C. $3\sqrt{3}$

D. 9

Answer: A

Detailed Explanation:

Simplify each surd term:

$\sqrt{27} = 3\sqrt{3}$, $\sqrt{12} = 2\sqrt{3}$, and

$\sqrt{9} = 3$.

Substitute back into the expression: $\frac{3\sqrt{3} \times 2\sqrt{3}}{3} = \frac{6 \times 3}{3} = 6$.

44. Find the values of k for which the quadratic equation $x^2 - kx + 9 = 0$ has equal real roots.

A. ± 6

B. ± 3

C. ± 9

D. 0

Answer: A

Detailed Explanation:

For equal roots, the discriminant must be zero ($b^2 - 4ac = 0$).

Here, $a = 1$, $b = -k$, $c = 9$.

$(-k)^2 - 4(1)(9) = 0 \implies k^2 - 36 = 0 \implies k^2 = 36$
 $\implies k = \pm 6$.

45. In a survey of 50 farmers, 35 grow cassava, 20 grow maize, and 5 grow neither. Find the number of farmers who grow both crops.

A. 10

B. 15

C. 5

D. 20

Answer: A

Detailed Explanation:

Total active crop-growing farmers $= 50 - 5 = 45$.

Using set theory: $n(C \cup M) = n(C) + n(M) - n(C \cap M)$.

$45 = 35 + 20 - n(C \cap M) \implies 45 = 55 - n(C \cap M)$
 $\implies n(C \cap M) = 10$.

46. Factorize the expression completely: $3x^2 - 11x - 4$.

A. $(3x + 1)(x - 4)$

B. $(3x - 1)(x + 4)$

C. $(3x - 4)(x + 1)$

D. $(3x + 4)(x - 1)$

Answer: A

Detailed Explanation:

Factorize numerator using difference of squares: $x^2 - 4 = (x - 2)(x + 2)$.

Factorize denominator quadratic: $x^2 - 3x + 2 = (x - 1)(x - 2)$.

Divide numerator by denominator to simplify: $\frac{(x - 2)(x + 2)}{(x - 1)(x - 2)} = \frac{x + 2}{x - 1}$.

49. Solve for x in the linear inequality: $4(x - 2) \geq 6x + 4$.

- A. $x \leq -6$
- B. $x \geq -6$
- C. $x \leq 6$
- D. $x \geq 6$

Answer: A

Detailed Explanation:

Expand brackets: $4x - 8 \geq 6x + 4$.

Collect terms: $4x - 6x \geq 4 + 8 \implies -2x \geq 12$.

Divide by -2 and flip the inequality sign: $x \leq \frac{12}{-2} \implies x \leq -6$.

50. Find the sum to infinity of a geometric progression whose first term is 12 and common ratio is $\frac{1}{4}$.

- A. 16
- B. 18
- C. 15

Find constant k : $9 = \frac{k(3^2)}{4}$ implies $9 = \frac{9k}{4}$ implies $k = 4$.

Calculate new y value: $y = \frac{4(2^2)}{2} = \frac{4}{2} \times 4 = 8$.

55. Evaluate $\sqrt{125} - 2\sqrt{20} + \sqrt{45}$ leaving your answer in simple surd form.

A. $4\sqrt{5}$

B. $2\sqrt{5}$

C. $3\sqrt{5}$

D. $5\sqrt{5}$

Answer: A

Detailed Explanation:

Simplify each surd:

$$\sqrt{125} = \sqrt{25 \times 5} = 5\sqrt{5}$$

$$2\sqrt{20} = 2\sqrt{4 \times 5} = 2(2\sqrt{5}) = 4\sqrt{5}$$

$$\sqrt{45} = \sqrt{9 \times 5} = 3\sqrt{5}$$

$$\text{Substitute back into the expression: } 5\sqrt{5} - 4\sqrt{5} + 3\sqrt{5} = 4\sqrt{5}.$$

56. Find the percentage profit made if an item bought for \$8,000 is sold for \$10,000.

A. 25%

B. 20%

C. 30%

D. 15%

Answer: A

From the given equation, $a = 2$ and $c = 6$.

Therefore, the product of the roots is $\frac{6}{2} = 3$.

61. Find the values of x and y that satisfy the simultaneous equations: $3x + 2y = 12$ and $4x - y = 5$.

A. $x = 2, y = 3$

B. $x = 3, y = 2$

C. $x = 1, y = 4$

D. $x = 4, y = 0$

Answer: A

Detailed Explanation:

From the second equation, isolate y : $y = 4x - 5$.

Substitute this into the first equation: $3x + 2(4x - 5) = 12$

$$\implies 3x + 8x - 10 = 12.$$

$$11x = 22 \implies x = 2.$$

Substitute $x = 2$ back into the expression for y : $y = 4(2) - 5 = 8 - 5 = 3$.

Thus, $x = 2$ and $y = 3$.

62. Evaluate the determinant of the matrix:

$$\begin{pmatrix} 5 & 3 \\ 2 & 4 \end{pmatrix}.$$

A. 14

B. 26

C. 22

D. 10

Answer: A

Detailed Explanation:

70. For what value of x is the algebraic fraction $\frac{2x + 5}{3x - 9}$ undefined?

- A. 3
- B. -3
- C. $-\frac{5}{2}$
- D. 0

Answer: A

Detailed Explanation:

An algebraic fraction is undefined when its denominator is equal to zero.

Set the denominator to zero and isolate x : $3x - 9 = 0$
 $\implies 3x = 9 \implies x = 3$.

71. Find the transpose of the matrix: $M = \begin{pmatrix} 1 & 4 \\ -2 & 5 \end{pmatrix}$.

- A. $\begin{pmatrix} 1 & -2 \\ 4 & 5 \end{pmatrix}$
- B. $\begin{pmatrix} 5 & 4 \\ -2 & 1 \end{pmatrix}$
- C. $\begin{pmatrix} 4 & 1 \\ 5 & -2 \end{pmatrix}$
- D. $\begin{pmatrix} -1 & -4 \\ 2 & -5 \end{pmatrix}$

Answer: A

Detailed Explanation:

The transpose of a matrix is formed by swapping its rows with its columns.

The first row $(1, 4)$ becomes the first column, and the second row $(-2, 5)$ becomes the second column.

This gives $\begin{pmatrix} 1 & -2 \\ 4 & 5 \end{pmatrix}$.