CREST Olympiads

#CRESTInnovator

CREST Mathematics Olympiad (CMO) Worksheet for Class 10

Topic

Number System and Polynomials

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Worksheet on Number System and Polynomials

1. **Which of the following is a rational number?**

   a. $5 + \sqrt{3}$
   b. $7 - \sqrt{2}$
   c. $8 + \sqrt{4}$
   d. $10 - \sqrt{5}$

2. **Out of the following polynomials, which polynomial has the highest degree?**

   a. $-8x^5 + 4x^3 - 3x + 2$
   b. $4x^4 + 2x^3 + x^2 - 1$
   c. $7x^5 + 3x^4 - 2x^3 + 4x^2 - 5x + 1$
   d. $12x^7 + 4x^6 - 2x^5 + 7x^4 + 3x^3 - 8x^2 + 4x + 3$

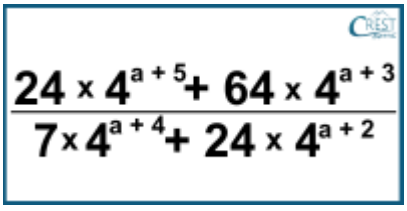
3. **When divided by $(x + 3)$, the polynomials $3x^3 + (p + 8)x^2 + 16x - 6$ and $x^3 - x^2 - px + 15$ leave the same remainder. What is the value of p?**

   a. 7
   b. 5
   c. 6
   d. 2

4. **If $a + b + c = 8$, then what is the value of $(a - 3)^3 + (b - 1)^3 + (c - 4)^3$.**

   a. 0
   b. 3
   c. $3(a - 3)(b - 1)(c - 4)$
   d. $(a - 3)(b - 1)(c - 4)$

5. **Using the law of exponents, simplify:**



   a. 224/17
   b. 228/17
   c. 220/17
   d. 232/17

Answer Key

1. c - 8 + √4

Explanation: The root of the numbers like √2, √3 and √5 are irrational numbers.

The sum of a rational number and an irrational number and the difference between a rational number and an irrational number is an irrational number. Hence, 5 + √3, 7 − √2 and 10 − √5 are irrational numbers.

The sum of two rational numbers is a rational number.

Number: 8 + √4 = 8 + √(2 x 2) = 8 + 2 = 10 = 10/1

8 + √4 is a rational number which is in the form 101 where both '10' and '1' are integers and '1' is not equal to zero.

2. d - $12x^7 + 4x^6 - 2x^5 + 7x^4 + 3x^3 - 8x^2 + 4x + 3$

Explanation: The degree of a polynomial is determined by the highest exponent of the variable within the expression.

The degree of the polynomial $-8x^5 + 4x^3 - 3x + 2$ is 5.

The degree of the polynomial $4x^4 + 2x^3 + x^2 - 1$ is 4.

The degree of the polynomial $7x^5 + 3x^4 - 2x^3 + 4x^2 - 5x + 1$ is 5.

The degree of the polynomial $12x^7 + 4x^6 - 2x^5 + 7x^4 + 3x^3 - 8x^2 + 4x + 3$ is 7.

Thus, the polynomial $12x^7 + 4x^6 - 2x^5 + 7x^4 + 3x^3 - 8x^2 + 4x + 3$ has the highest degree.

3. a - 7

Explanation: The Remainder Theorem states that if you divide a polynomial f(x) by x−c, where c is a constant, the remainder will be f(c).

When x = −3,

For polynomial $3x^3 + (p + 8)x^2 + 16x - 6$,

$R^1 = 3(-3)^3 + (p + 8)(-3)^2 + 16(-3) - 6$
$R^1 = -81 + (p + 8)(9) - 48 - 6$
$R^1 = -81 + 9p + 72 - 54$
$R^1 = 9p - 63$

For polynomial $x^3 - x^2 - px + 15$,

$R_2 = (-3)^3 - (-3)^2 - p(-3) + 15$

$R_2 = -27 - 9 + 3p + 15$
$R_2 = 3p - 21$

Since $R_1 = R_2$
$\rightarrow 9p - 63 = 3p - 21$
$\rightarrow 9p - 3p = -21 + 63$
$\rightarrow 6p = 42$
$\rightarrow p = 42/6$
$\rightarrow p = 7$

4. c - 3(a − 3)(b − 1)(c − 4)

Explanation: a + b + c = 8
(a − 3) + (b − 1) + (c − 4) = 0

Let A = a − 3, B = b − 1 and C = c − 4
A + B + C=0

We know that if a + b + c = 0, then $a^3 + b^3 + c^3 = 3abc$

Thus, $A^3 + B^3 + C^3 = 3ABC$
$(a - 3)^3 + (b - 1)^3 + (c - 4)^3 = 3(a - 3)(b - 1)(c - 4)$

5. a - 224/17

Explanation: We know that if a, b, m and n are real numbers, then:

$$a^m \times a^n = a^{m+n}$$

$$\frac{a}{a} = a^{m-n}$$

$$\Rightarrow \frac{24 \times 4^{a+5} + 64 \times 4^{a+3}}{7 \times 4^{a+4} + 24 \times 4^{a+2}} = \frac{6 \times 4 \times 4^{a+5} + 4^3 \times 4^{a+3}}{7 \times 4^{a+4} + 6 \times 4 \times 4^{a+2}}$$

$$= \frac{6 \times 4^{a+6} + 4^{a+6}}{7 \times 4^{a+4} + 6 \times 4^{a+3}}$$

$$= \frac{4^{a+6}(6+1)}{4^{a+3}(7 \times 4 + 6)}$$

$$= \frac{4^{(a+6)-(a+3)}(7)}{(28 + 6)}$$

$$= \frac{4^3(7)}{34}$$

$$= \frac{64 \times (7)}{34}$$

$$= \frac{224}{17}$$

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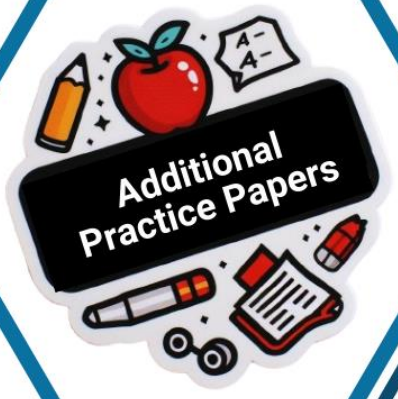

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