MATHS

BOOKS - MTG IIT JEE FOUNDATION

POLYNOMIALS

Illustrations

1. Find the degree of each of the polynomials given below:(i) $x^5 - x^4 + 3$ (ii) $2 - y^2 - y^3 + 2y^8$ (iii) 2

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2. Write the coefficients of the highest degree terms in the following polynomials : $10m^2 - 3m$

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3. Find the value of the polynomial $p(x) = x^3 - 2x^2 - 2x - 3$ at $x = 3$

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4. Verify whether 2 and 0 are zeroes of the polynomial $x^2 - 2x$.

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5. Using remainder theorem, find the remainder when $x^4 + x^3 - 2x^2 + x + 1$ is divided by $x - 1$.

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6. Examine whether $y + 3$ is a factor of the polynomial $2y^3 + 3y^2 - 7y + 6$.

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7. Factorise the polynomial $x^2 + 7x + 12$ by splitting the middle term .

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8. Factorise : $x^3 - 23x^2 + 142x - 120$

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9. Use suitable identities to find the following products :

(i) $(2x + 7y)(2x + 7y)$

(ii) $(3x - 5y)(3x - 5y)$

(iii) $(5x + 3y)(5x - 3y)$

(iv) $(5x + 2y)(5x + 3y)$.

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10. Factorise :

(i) $36a^2 + 60ab + 25b^2$

(ii) $\frac{25}{4}x^2 - \frac{y^2}{81}$

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11. Expand $(4a - 2b - 3c)^2$.

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12. Factorise : $4x^2 + y^2 + z^2 - 4xy - 2yz + 4xz$.

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13. Write the following cubes in the expanded form :

(i) $(2a + 3b)^3$

(ii) $(3p - 5q)^3$

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14. Factorise : $8x^3 + y^3 + 27z^3 - 18xyz$.

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Solved Examples

1. Find the zeroes of the polynomial $x^3 + 6x^2 + 11x + 6$ which are integers .

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2. If $x = \frac{4}{3}$ is a zero of the polynomial $p(x) = 6x^3 - 11x^2 + kx - 20$, then find the value of k .

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3. If the polynomials $ax^3 + 4x^2 + 3x - 4$ and $x^3 - 4x + a$ leave the same remainder when divided by $(x - 3)$, find the value of a .

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4. The polynomials $ax^3 + 3x^2 - 13$ and $2x^3 - 5x + a$ are divided by $(x + 2)$. If the remainder in each case is same , then find the value of a .

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5. Let R_1 and R_2 are the remainders when the polynomials $x^3 + 2x^2 - 5ax - 7$ and $x^3 + ax^2 - 12x + 6$ are divided by $x + 1$ and $x - 2$ respecti-vely. If $2R_1 + R_2 = 6,$ find the value of a.

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6. If $x^2 - 1 = 0$ is a factor of $ax^4 + bx^3 + cx^2 + dx + e$; show that $a + c + e = b + d = 0$

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7. In each of the following polynomials, find the value of a if $x + a$ is a factor of

(i) $x^3 + ax^2 - 2x + a + 4$

(ii) $x^4 - a^2x^2 + 3x - a$

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8. What must be added to $x^4 + 2x^3 - 2x^2 + x - 1$ so that the result is exactly divisible by $x^2 + 2x - 3$.

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9. Evaluate 103×97 by using identities .

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10. If $a^2 + b^2 + c^2 = 20$ and $a + b + c = 9$, find ab+bc+ca .

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11. What must be subtracted from $4x^4 - 2x^3 - 6x^2 + x - 5$ so that the result is exactly divisible by $2x^2 + x - 17$

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12. If $a^2 + b^2 + c^2 = 250$ and ab+bc+ca = 3 , find a+b+c .

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13. if $x^2 + \frac{1}{x^2} = 83$. Find the value of $x^3 - \frac{1}{x^3}$

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14. Evaluate: $30^3 + 20^3 - 50^3$

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15. If $a + b + c = 15 \, and \, a^2 + b^2 + c^2 = 83$, find the value of $a^3 + b^3 + c^3 - 3abc$

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Ncert Section Exercise 2 1

1. Which of the following expressions are polynomials in one variable and which are not ? State reasons for your answer .

(i) $4x^2 - 3x + 7$

(ii) $y^2 + \sqrt{2}$

(iii) $3\sqrt{t} + t\sqrt{2}$

(iv) $y = \frac{2}{y}$

(v) $x^{10} + y^3 + t^{50}$

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2. Write the coefficients of x^2 in each of the following :

(i) $2 + x^2 + x$

(ii) $2 - x^2 + x^3$

(iii) $\frac{\pi}{2}x^2 + x$

(iv) $\sqrt{2}x - 1$

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3. Give one example each of a binomial of degree 35 and of a monomial of degree 100.

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4. Write the degree of each of the following polynomials :

(i) $5x^3 + 4x^2 + 7x$

(ii) $4 - y^2$

(iii) $5t - \sqrt{7}$

(iv) 3

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5. Classify the following as linear, quadratic and cubic polynomials:

(i) $x^2 + x$

(ii) $x - x^3$

(iii) $y + y^3 + 4$

(iv) $1 + x$

(v) 3t

(vi) r^2

(vii) $7x^3$

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Ncert Section Exercise 2 2

1. Find the value of the polynomial $5x - 4x^2 + 3$ at :

$(i) x = 0$ $(ii) x = -1$ $(iii) x = 2$

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2. Find p(0), p(1) and p(2) for each of the following polynomials :

(i) $p(y) = y^2 - y + 1$

(ii) $p(t) = 2 + t + 2t^2 - t^3$

(iii) $p(x) = x^3$

(iv) $p(x) = (x - 1)(x + 1)$

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3. Verify whether the following are zeroes of the polynomial, indicated against them .

(i) $p(x) = 3x + 1, x = -\frac{1}{3}$

(ii) $p(x) = 5x - \pi, x = \frac{4}{5}$

(iii) $p(x) = x^2 - 1, x = 1, -1$

(iv) $p(x) = (x + 1), (x - 2), x = -1, 2$

(v) $p(x) = x^2, x = 0$

(vi) $p(x) = lx + m, x = \frac{-m}{l}$

(vii) $p(x) = 3x^2 - 1, x = -\frac{1}{\sqrt{3}}, \frac{2}{\sqrt{3}}$

(viii) $p(x) = 2x + 1, x = \frac{1}{2}$

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4. Find the zero of the polynomial in each of the followimg cases :

(i) $p(x) = x + 5$

(ii) $p(x) = x - 5$

(iii) $p(x) = 2x + 5$

(iv) $p(x) = 3x - 2$

(v) $p(x) = 3x$

(vi) $p(x) = ax, a \neq 0$

(vii) $p(x) = cx + d, c \neq 0, c, d$ are real numbers .

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Ncert Section Exercise 2 3

1. Find the remainder when $x^3 + 3x^2 + 3x + 1$ is divided by

(i) $x + 1$

(ii) $x - 1/2$

(iii) x

(iv) $x + \pi$

(v) $5 + 2x$

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2. Find the remainder when

$x^3 - ax^2 + 6x - a$ is divided by x - a

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3. Cheak whether $7 + 3x$ is a factor of $3x^3 + 7x$.

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Ncert Section Exercise 2 4

1. Determine which of the following polynomials has $(x + 1)$ a factor :

(i) $x^3 + x^2 + x + 1$

(ii) $x^4 + x^3 + x^2 + x + 1$

(iii) $x^4 + 3x^3 + 3x^2 + x + 1$

(iv) $x^3 - x^2 - (2 + \sqrt{2})x + \sqrt{2}$

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2. Use the factor theorem, to determine whether $g(x)$ is a factor of $p(x)$ in each of the following cases :

(i) $p(x) = 2x^3 + x^2 - 2x - 1, g(x) = x + 1$

(ii) $p(x) = x^3 + 3x^2 + 3x + 1, g(x) = x + 2$

(iii) $p(x) = x^3 - 4x^2 + x + 6, g(x) = x - 3$

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3. Find the value of k , if $x - 1$ is a factor of $p(x)$ in each of the following cases :

(i) $p(x) = x^2 + x + k$

(ii) $p(x) = 2x^2 + kx + \sqrt{2}$

(iii) $p(x) = kx^2 - \sqrt{2}x + 1$

(iv) $p(x) = kx^2 - 3x + k$

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4. Factorise:(i) $12x^2 - 7x + 1$ (ii) $2x^2 + 7x + 3$ (iii) $6x^2 + 5x - 6$ (iv) $3x^2 - x - 4$

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5. Factorise: (i) $x^3 - 2x^2 - x + 2$ (ii) $x^3 - 3x^2 - 9x - 5$ (iii) $x^3 + 13x^2 + 32x + 20$(iv) $2y^3 + y^2 - 2y - 1$

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Ncert Section Exercise 2 5

1. Use suitable identities to find the following products :

(i) $(x + 4)(x + 10)$ $(ii)(x + 8)(x - 10)$

$(iii)(3x + 4)(3x - 5)$ $(iv)\left(y^2 + \frac{3}{2}\right)\left(y^2 - \frac{3}{2}\right)$

$(v)(3 - 2x)(3 + 2x)$

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2. Evaluate the following products without multiplying directly :

(i) 103×107

(ii) 95×96

(iii) 104×96

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3. Factorise the following using appropriate identities :

$(i) 9x^2 + 6xy + y^2$ $(ii) 4y^2 - 4y + 1$ $(iii) x^2 - \frac{y^2}{100}$

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4. Expand each of the following, using suitable identities :

(i) $(x + 2y + 4z)^2$

(ii) $(2x - y + z)^2$

(iii) $(-2x + 3y + 2z)^2$

(iv) $(3a - 7b - c)^2$

(v) $(-2x+5y-3z)^2$

(vi) $\left[\frac{1}{4}a-\frac{1}{2}b+1\right]^2$

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5. Factorise :

(i) $4x^2+9y^2+16z^2+12xy-24yz-16xz$

(ii) $2x^2+y^2+8z^2-2\sqrt{2}xy+4\sqrt{2}yz-8xz$

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6. Write the following cubes in expanded form :

(i) $(2x+1)^3$

(ii) $(2a-3b)^3$

(iii) $\left[\frac{3}{2}x+1\right]^3$

(iv) $\left[x-\frac{2}{3}y\right]^3$

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7. Evaluate the following using suitable identities :

(i) $(99)^3$

(ii) $(102)^3$

(iii) $(998)^3$

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8. Factorise each of the following :

(i) $8a^3 + b^3 + 12a^2b + 6ab^2$

(ii) $8a^3 - b^3 - 12a^2b + 6ab^2$

(iii) $27 - 125a^3 - 135a + 225a^2$

(iv) $64a^3 - 27b^3 - 144a^2b + 108ab^2$

(v) $27p^3 - \frac{1}{216} - \frac{9}{2}p^2 + \frac{1}{4}p$

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9. Verify : (i) $x^3 + y^3 = (x + y)\left(x^2 - xy + y^2\right)$

(ii) $x^3 - y^3 = (x - y)\left(x^2 + xy + y^2\right)$

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10. Factorise each of the following :

(i) $27y^3 + 125z^3$

(ii) $64m^3 - 343n^3$

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11. Factorise : $27x^3 + y^3 + z^3 - 9xyz$

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12. Verify that

$x^3 + y^3 + z^3 - 3xyz = \frac{1}{2}(x + y + z)\left[(x - y)^2 + (y - z)^2 + (z - x)^2\right]$

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13. If $x + y + z = 0$show that $x^3 + y^3 + z^3 = 3xyz$.

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14. Without actually calculating the cubes, find the value of each of the following:(i) $(-12)^3 + (7)^3 + (5)^3$ (ii) $(28)^3 + (-15)^3 + (-13)^3$

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15. Give possible expressions for the length and breadth of each of the following rectangles, in which their areas are given :

(i) Area : $25a^2 - 35a + 12$

(ii) Area : $35y^2 + 13y - 12$

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16. What are the possible expressions for the dimensions of the cuboids whose volumes are given by ?

(i) Volume : $3x^2 - 12x$

(ii) Volume : $12ky^2 + 8ky - 20k$

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Exercise Multiple Choice Question Level 1

1. Which one of the following algebraic expressions is a polynomial in variable x ?

A. $x^2 + \frac{2}{x^2}$

B. $\sqrt{x} + \frac{1}{\sqrt{x}}$

C. $x^2 + \frac{3x^{3/2}}{\sqrt{x}}$

D. None of these

Answer: C

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2. Degree of the polynomial $p(x) = 3x^4 + 6x + 7$ is

A. 4

B. 5

C. 3

D. 1

Answer: A

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3. Degree of the polynomial $p(x) = (x + 2)(x - 2)$ is

A. 2

B. 1

C. 0

D. 3

Answer: A

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4. If $8x^4 - 8x^2 + 7$ is divided by $2x + 1$, the remainder is

A. $\frac{11}{2}$

B. $\frac{13}{2}$

C. $\frac{15}{2}$

D. $\frac{17}{2}$

Answer: A

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5. Condition identitiy : If $a+b+c=0$ then $a^3+b^3+c^3=3abc$

A. abc

B. 3abc

C. 2abc

D. `-3abc

Answer: B

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6. Factors of x^4-x^2-12 are

A. $(x+2),(x-2),\left(x^2+3\right)$

B. $(x+3),(x-3),\left(x^2+2\right)$

C. $(x+2),(x-2),\left(x^2-3\right)$

D. $\left(x^2+2\right),\left(x^2-6\right)$

Answer: A

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7. Factorisation of $a^{2x} - b^{2x}$ is

A. $(a^x + b^x)(a^x - b^x)$

B. $(a^x - b^x)^2$

C. $(a^x + b^x)(a^2 - b^2)$

D. $(a^x - b^x)(a^2 + b^2)$

Answer: A

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8. $x^2 + (a + b + c)x + ab + bc =$ _____

A. $(x + a)(x + b + c)$

B. $(x+a)(x+a+c)$

C. $(x+b)(x+a+c)$

D. $(x+b)(x+b+c)$

Answer: C

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9. For the polynomial $p(x) = x^5 + 4x^3 - 5x^2 + x - 1$, one of the factors is

A. $(x+1)$

B. $(x-1)$

C. x

D. $(x+2)$

Answer: B

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10. Factorize: $a^2 + b^2 + 2(ab + bc + ca)$

A. $(a + b)(a + b + 2c)$

B. $(b + c)(c + a + 2b)$

C. $(c + a)(a + b + 2c)$

D. $(b + a)(b + c + 2a)$

Answer: A

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11. Factorisation of $x^2 + 3\sqrt{2}x + 4$ is

A. $\left(x + 2\sqrt{2}\right)\left(x + \sqrt{2}\right)$

B. $\left(x + 2\sqrt{2}\right)\left(x - \sqrt{2}\right)$

C. $\left(x - 2\sqrt{2}\right)\left(x + \sqrt{2}\right)$

D. $\left(x-2\sqrt{2}\right)\left(x-\sqrt{2}\right)$

Answer: A

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12. Factorisation of $x^2-1-2a-a^2$ is

A. $(x-a-1)(x+a-1)$

B. $(x+a+1)(x-a-1)$

C. $(x+a+1)(x-a+1)$

D. $(x-a+1)(x+a-1)$

Answer: B

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13. Which of the following algebraic expressions is not a polynomial ?

A. $\frac{17}{2}x^2 + x - 3$

B. $\sqrt{7}x^3 + 3x^{2/3} - 8$

C. 3

D. 0

Answer: B

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14. Factors of $\left(42 - x - x^2\right)$ are

A. $(x - 7), (x - 6)$

B. $(x + 7), (x - 6)$

C. $(x + 7), (6 - x)$

D. $(x - 7), (x + 6)$

Answer: C

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15. In the method of factorisation of an algebraic expression, which of the following statement is false ?

A. Taking out a common factor from two or more terms .

B. Taking out a common factor from a group of terms .

C. Using remainder theorem .

D. Using standard identities .

Answer: C

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16. Factors of $(a+b)^3-(a-b)^3$ are

A. $2ab,\ \left(3a^2+b^2\right)$

B. $ab,\ \left(3a^2+b^2\right)$

C. $2b, \left(3a^2 + b^2\right)$

D. $\left(3a^2 + b^2\right), 2a$

Answer: C

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17. The common quantity that must be added to each term of $a^2 : b^2$ to make it equal to a:b is

A. ab

B. $a + b$

C. a-b

D. $\frac{a}{b}$

Answer: A

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18. One of the dimensions of the cuboid whose volume is $16x^2 - 26x + 10$ is

A. 2

B. $(8x - 5)$

C. $(x - 1)$

D. All of these

Answer: D

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19. find the value of x+y+z if $x^2 + y^2 + z^2 = 18$ and $xy + yz + zx = 9$.

A. 9

B. 3

C. 6

D. 8

Answer: C

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20. Find the remainder when the polynomial $f(x) = x^3 - 3x^2 + 4x + 50$ is divided by $x + 3$.

A. -16

B. -12

C. -20

D. -10

Answer: A

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21. The value of a for which $(x+a)$ is a factor of the polynomial $x^3+ax^2-2x+a+6$ is

A. 4

B. 2

C. -4

D. -2

Answer: D

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22. Factorisation of the polynomial $\sqrt{3}x^2+11x+6\sqrt{3}$

A. $\left(\sqrt{3}x+2\right)\left(x-3\sqrt{3}\right)$

B. $\left(\sqrt{3}x+2\right)\left(x+3\sqrt{3}\right)$

C. $\left(\sqrt{2}x+3\right)\left(x+2\sqrt{3}\right)$

D. $\left(\sqrt{2}x - 2\right)\left(x + 3\sqrt{2}\right)$

Answer: B

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23. If $x = -2$ and $x^2 + y^2 + 2xy = 0$, then find y .

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24. If $x + \frac{1}{x} = 5$, then find the value of $x^2 + \frac{1}{x^2}$.

A. 26

B. 23

C. 30

D. 22

Answer: B

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25. Find the value of $x^3 - 8y^3 - 36xy - 216$, when $x = 2y + 6$.

A. -1

B. 2

C. 0

D. 3

Answer: C

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26. Simplify : $\frac{x^3 - 4 - x + 4x^2}{x^2 + 3x - 4}$

A. $4 + x$

B. $2 + x$

C. $1 - x$

D. $x + 1$

Answer: D

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27. Which of the following is true if $(x + 1)$ and $(x + 2)$ are factors of $p(x) = x^3 + 3x^2 - 2\alpha x + \beta$?

A. $2\alpha + 2\beta = 2$

B. $2\alpha - 3\beta = -2$

C. $\alpha - 7\beta = 5$

D. $7\alpha - \beta = 2$

Answer: B

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28. Factorise : $6x^3 - 5x^2 - 13x + 12$

A. $(x - 1)(3x - 4)(2x + 3)$

B. $(x + 1)(3x + 4)(2x - 3)$

C. $(x - 1)(3x - 4)(2x - 3)$

D. $(x + 1)(3x + 4)(2x + 3)$

Answer: A

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29. If $p(x) = x^3 - 3x^2 - 2x + 4$, then find the value of $[p(2) + p(-2) - p(0)]$.

A. 28

B. 14

C. -20

D. 16

Answer: -20

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30. If $p = 2 - a$, then $a^3 + 6ap + p^3 - 8 =$

A. 0

B. 1

C. 2

D. 3

Answer: A

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31. The polynomial $p(x) = x^4 - 2x^3 + 3x^2 - ax + 3a$ when divided by $(x + 1)$ leaves the remainder 19. Find the value of a .

A. $19/4$

B. $13/4$

C. $1/4$

D. $17/4$

Answer: B

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32. The values of a and b so that the polynomial $x^3 - ax^2 - 13x + b$ has $(x - 1)$ and $(x + 3)$ as factors respectively are

A. $3, 15$

B. $5, 13$

C. $15, 3$

D. $5, 10$

Answer: A

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33. The product $(a+b)(a-b)\left(a^2-ab+b^2\right)\left(a^2+ab+b^2\right)$ is equal to: a^6+b^6 (b) a^6-b^6 (c) a^3-b^3 (d) a^3+b^3

A. a^6+b^6

B. a^6-b^6

C. a^3-b^3

D. a^3+b^3

Answer: B

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34. Posible factors of $x^4 + x^3 - 7x^2 - x + 6$ are

A. $x + 1$

B. $x + 3$

C. $x - 2$

D. All of these

Answer: D

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35. If $a + b + c = 0$, then $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab} =$ 0 (b) 1 (c) -1 (d) 3

A. 0

B. 1

C. -1

D. 3

Answer: D

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Exercise Multiple Choice Question Level 2

1. One of the factor of $(a+2b)^3+(2a-c)^3-(a+2c)^3+3(a+2b)(2a-c)(a+2c)$ is

A. $2a+2b-3c$

B. $2a-2b+3c$

C. $2a+2b+3c$

D. $-2a-2b-3c$

Answer: A

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2. Factors of $\left(x^2 + \frac{x}{6} - \frac{1}{6}\right)$ are

A. $\frac{1}{6}, (2x+1), (3x+1)$

B. $\frac{1}{6}, (2x+1), (3x-1)$

C. $\frac{1}{6}, (2x-1), (3x-1)$

D. $\frac{1}{6}, (2x-1), (3x+1)$

Answer: B

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3. Factorise : $p^3(q-r)^3 + q^3(r-p)^3 + r^3(p-q)^3$

A. $2pq(p+q)(q+r)(r-p)$

B. $3pqr(p-q)(r-q)(r-p)$

C. $2pqr(p-q)(q-r)(p-r)$

D. $3pqr(p-q)(q-r)(r-p)$

Answer: D

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4. If both $x = 2$ and $x = \frac{1}{2}$ are factors of $px^2 + 5x + r$, then p=

A. $\frac{3}{4}r$

B. $2r$

C. $\frac{r}{2}$

D. r

Answer: D

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5. The following steps are involved in finding the value of $a^4 + \frac{1}{a^4}$ when $a + \frac{1}{a} = 1$. Arrange them in sequential order from the first to the last .

(A) $a^2 + \frac{1}{a^2} + 2 = 1 \Rightarrow a^2 + \frac{1}{a^2} = -1$

(B) $\left(a^2\right)^2+\left(\frac{1}{\left(a^2\right)^2}\right)^2=1^2$

(C) $\left(a+\frac{1}{a}\right)^2=1^2$

(D) $\left(a^2+\frac{1}{a^2}\right)^2=(-1)^2$

E $a^4+\frac{1}{a^4}=-1$

A. CADBE

B. CDBAE

C. CBADE

D. CEDAB

Answer: A

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6. If $3x+\frac{2}{x}=7$, then $\left(9x^2-\frac{4}{x^2}\right)=$ 25 (b) 35 (c) 49 (d) 30

A. 25

B. 35

C. 49

D. 30

Answer: B

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7. If $x^4 + \frac{1}{x^4} = 194$. Find the value of $\left(x^3 + \frac{1}{x^3}\right)$.

A. 54

B. 52

C. 64

D. 62

Answer: B

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8. What must be subtracted from $x^3 - 6x^2 - 15x + 80 = 0$ so that the resultant is exactly divisible by $x^2 + x - 12$?

A. $x + 4$

B. $4x - 4$

C. $4x + 4$

D. $x - 4$

Answer: B

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9. Simplify each : $(4x + 2y)^3 + (4x - 2y)^3$

A. $128x^3 + 96xy^2$

B. $128x^3 + 96x^2y$

C. $128x^3 + 48y^2$

D. None of these

Answer: A

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10. If x and y be two positive real numbers such that $x > 3y$, $x^2 + 9y^2 = 369$ and $xy = 60$, then the value of $x - 3y$ is

A. 4

B. 3

C. 2

D. 5

Answer: B

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11. If $x + y = 5$ and $xy = 6$, then the value of $x^3 + y^3$ is

A. 35

B. 45

C. 30

D. 125

Answer: A

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12. If the polynomials $2x^3 + ax^2 + 3x - 5$ and $x^3 + x^2 - 4x + a$ leave the same remainder when divided by $x - 2$, then the value of a is

A. $13/3$

B. $-13/3$

C. $26/3$

D. $-26/3$

Answer: B

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13. If the polynomial $a-2x+5x^2$ is divided by $x-2$, it leaves remainder 7. Then, the value of a is

A. -9

B. 9

C. 7

D. -7

Answer: A

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14. Find the value of $p^3 - q^3$, if $p - q = \frac{10}{9}$ and $pq = \frac{5}{3}$

A. $\frac{5050}{729}$

B. $\frac{5050}{8}$

C. $5051 / 729$

D. $4050 / 729$

Answer: A

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15. Simplify : $\left(\frac{x}{3} + \frac{y}{5}\right)^3 - \left(\frac{x}{3} - \frac{y}{5}\right)^3$

A. $\frac{2x}{5}\left(\frac{x^2}{3} - \frac{y^2}{25}\right)$

B. $\frac{2y}{5}\left(\frac{x^2}{3} - \frac{y^2}{25}\right)$

C. $\frac{2x}{5}\left(\frac{x^2}{3} + \frac{y^2}{25}\right)$

D. $\frac{2y}{5}\left(\frac{x^2}{3} + \frac{y^2}{25}\right)$

Answer: D

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Exercise Match The Following

1. List-II shows the degree of polynomials given in List -I.

List-I		List-II	
(P)	$\left(\frac{81}{16}\right)^{-\frac{3}{4}} \times \left\{\left(\frac{25}{9}\right)^{-\frac{3}{2}} + \left(\frac{5}{2}\right)^{-3}\right\}$	(1)	$\frac{3}{80}$
(Q)	$\frac{\sqrt[3]{0.125} \times \sqrt[5]{(0.00032)^{-2}}}{\sqrt[5]{(0.00243)^{-3}} \times (27)^{2/3}}$	(2)	$\frac{39 + 8\sqrt{30}}{21}$
(R)	$\sqrt[4]{(81)^{-2}}$	(3)	$\frac{1}{9}$
(S)	$\frac{2\sqrt{6} + \sqrt{5}}{3\sqrt{5} - 2\sqrt{6}}$	(4)	1

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2. List-II gives value of k for polynomials given in List - I when it is completely divisible by $x - 1$.

List-I		List-II	
(P)	$\frac{2}{\sqrt{5}-\sqrt{3}}$	(1)	4.357
(Q)	$\frac{\pi}{2}+\frac{3}{\sqrt{5}}$	(2)	3.968
(R)	$\frac{1}{2\sqrt{5}-3\sqrt{2}}$	(3)	2.912
(S)	$\pi+1/\sqrt{2}$	(4)	3.848

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3. List-II gives value of the polynomials given in List -I at the given points .

List-I		List-II	
(P)	If $x = \frac{\sqrt{7}}{5}$ and $\frac{5}{x} = p\sqrt{7}$, then $p =$	(1)	7
(Q)	If $x = \sqrt{5} - 2$, then $\left(x^2 + \frac{1}{x^2}\right) =$	(2)	0
(R)	If $5^{x-3} \cdot 3^{2x-8} = 455625$, then $x =$	(3)	18
(S)	If $2^x = 3^y = 6^{-z}$, then $1/x + 1/y + 1/z =$	(4)	25/7

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Exercise Assertion Reason Type

1. Assertion : $(x+2)$ and $(x-1)$ are factors of the polynomial $x^4 + x^3 + 2x^2 + 4x - 8$.

Reason : For a polynomial $p(x)$ of degree ≥ 1, $x - a$ is a factor of the polynomial $p(x)$ if and only if $p(a) \geq 1$.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If assertion is false but reason is true .

Answer: C

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2. Assertion : The remainder when $p(x) = x^3 - 6x^2 + 2x - 4$ is divided by $(3x - 1)\text{is}\frac{-107}{27}$

Reason : If a polynomial $p(x)$ is divided by $ax - b$, the remainder is the value of $p(x)\text{at}\left(x = \frac{b}{a}\right)$.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If assertion is false but reason is true .

Answer: A

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3. Assertion : The degree of the polynomial $(x-2)(x-3)(x+4)$ is 4 .

Reason : The number of zeroes of a polynomial is the degree of that polynomial .

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If assertion is false but reason is true .

Answer: D

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4. Assertion : The expression $3x^4 - 4x^{3/2} + x^2 = 2$ is not a polynomial because the term $-4x^{3/2}$ contains a rational power of x .

Reason : The highest exponent in various terms of an algebraic expression in one variable is called its degree .

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If assertion is false but reason is true .

Answer: B

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5. Assertion : $3x^2 + x - 1 = (x + 1)(3x - 2) + 1$.

Reason : If $p(x)$ and $g(x)$ are two polynomials such that degree of $p(x) \geq$ degree of $g(x)$ and $g(x) \geq 0$ then we can find polynomials $q(x)$ and $r(x)$ such that $p(x) = g(x).\, q(x) + r(x)$, where $r(x) = 0$ or degree of $r(x) <$ degree of $g(x)$.

A. If both assertion and reason are true and reason is the correct explanation of assertion .

B. If both assertion and reason are true but reason is not the correct explanation of assertion .

C. If assertion is true but reason is false .

D. If assertion is false but reason is true .

Answer: A

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Exercise Comprehension Type

1. For a polynomial $p(x)$ of degree $\geq 1, p(a) = 0$, where a is a real number, then $(x - a)$ is a factor of the polynomial $p(x)$

$p(x) = x^3 - 3x^2 + 4x - 12$, then $p(3)$ is

A. 0

B. 1

C. -1

D. 2

Answer: A

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2. For a polynomial $p(x)$ of degree $\geq 1, p(a) = 0$, where a is a real number, then $(x - a)$ is a factor of the polynomial $p(x)$

For what value of k, the polynomial $2x^4 + 3x^3 + 2kx^2 + 3x + 6$ is exactly divisible by $(x + 2)$?

A. 0

B. -1

C. 1

D. 2

Answer: B

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3. For a polynomial $p(x)$ of degree $\geq 1, p(a) = 0$, where a is a real number, then $(x - a)$ is a factor of the polynomial $p(x)$

Find the value of k if $x - 1$ is a factor of $4x^3 + 3x^2 - 4x + k$.

A. 0

B. 1

C. -3

D. 2

Answer: C

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4. A polynomial of degree $n \geq 1$ can have at most n real zeroes. A quadratic polynomial can have at most two real zeroes .

Find the zero of the polynomial $q(u) = 3u$.

A. 0

B. 3

C. 2

D. 1

Answer: A

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5. A polynomial of degree $n \geq 1$ can have at most n real zeroes. A quadratic polynomial can have at most two real zeroes .

find the zeroes of the polynomial $p(x) = 3x^2 + 7x + 2$.

A. $1, \ -1/3$

B. $-1/3, \ -2$

C. $2/3, 1$

D. $1/3, 2$

Answer: B

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6. A polynomial of degree $n \geq 1$ can have at most n real zeroes. A quadratic polynomial can have at most two real zeroes .

Find $p(1)$, if $p(x) = x^3 - 22x^2 + 141x - 120$.

A. -1

B. -12

C. 0

D. 9

Answer: C

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Exercise Subjective Problems Very Short Answer Type

1. Find zeroes of the polynomials given below :

(i) $3x + \pi$

(ii) $ly + m, l \neq 0$

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2. Factorise : $a^3 - b^3 + 1 + 3ab$

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3. Expand $(4x - 3y - 2z)^2$.

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4. Give possible expressions for the length and breadth of the rectangle whose area is given as $16a^2 - 32a + 15$ square units , $a > \frac{5}{4}$.

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5. Factorise : $x^4 - 3x^2 + 2$

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6. Factorise : $(p-q)^3 + (q-r)^3 + (r-p)^3$

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7. The polynomials $ax^3 + 3x^2 - 3$ and $2x^3 - 5x + a$ when divided by $(x-4)$ leave the remainders $R_1 and R_2$ respectively. Find the values of a in each of the following cases, if $R_1 = R_2$ (ii) $R_1 + R_2 = 0$ $2R_1 - R_2 = 0$

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8. Factorise : $x^2 - x\left(\frac{a^2-1}{a}\right) - 1$

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9. show that $(3a + 2b - c + d)^2 - 12a(2b - c + d)$ is a perfect square .

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Exercise Subjective Problems Short Answer Type

1. Use factor theorem to verify that y+a is factor of $y^n + a^n$ for any odd positive integer n .

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2. If x and y be two positive real numbers such that $4x^2 + y^2 = 40$ and $xy = 6$, then find the value od $2x + y$.

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3. If the perimeter of a rectangle is 24 units and the length exceeds the breadth by 4 units, then find the area of a rectangle .

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4. Without actually calculating the cubes, evaluate the expression $(30)^3 + (-18)^3 + (-12)^3$.

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5. For what value of k is the polynomial $\left(2x^4 + 3x^3 + 2kx^2 + 3x + 6\right)$ exactly divisible by $(x - 2)$?

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6. Factorize: $5(3x + y)^2 + 6(3x + y) - 8$

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7. If $x + \frac{1}{x} = 4$, then find $x^3 + \frac{1}{x^3}$

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8. If $x = a + b, y = b + c, z = c + a$, prove that $(x + y + z) \times \{x^2 + y^2 + z^2 - xy - yz - zx\} = 2(a^3 + b^3 + c^3 - 3abc)$

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9. If $2a + b = 12$ and $ab = 15$, then find the value of $8a^3 + b^3$.

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10. Without actual division, prove that $2x^4 - 6x^3 + 3x^2 + 3x - 2$ is exactly divisible by $x^2 - 3x + 2$

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Exercise Subjective Problems Long Answer Type

1. If $x = \sqrt{7} - \sqrt{5}, y = \sqrt{5} - \sqrt{3}, z = \sqrt{3} - \sqrt{7}$ then find the value of $x^3 + y^3 + z^3 - 2xyz$

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2. If $ax^3 + bx^2 + x - 6$ has $x + 2$ as a factor and leaves a remainder 4 when divided by $(x - 2)$, find the value of a and b.

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3. Given that $px^2 + qx + 6$ leaves the remainder as 1 on division by $2x = 1$ and $2qx^2 + 6x + p$ leaves the remainder as 2 on division by $3x - 1$. Find p and q .

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4. The polynomial $ax^3 + 3x^2 - 3$ and $2x^3 - 5x + a$ when divided by $x - 1$ leaves the remainders R_1 and R_2 respectively . Find the value of a , if $2R_1 - R_2 = 0$.

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5. Simplify : $\frac{(a^2 - b^2)^3 + (b^2 - c^2)^3 + (c^2 - a^2)^3}{(a - b)^3 + (b - c)^3 + (c - a)^3}$

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Exercise Integral Numerical Value Type

1. $p(x) = \sqrt{2}$ is a polynomial of degree

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2. Find the degree of the polynomial $(x+2)\left(x^2-2x+4\right)$.

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3. If $a=7$, then find the degree of the polynomial $p(x)=(x-a)^3+343$.

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4. What is the remainder if $p(x)=x^3+2x+1$ is divided by $x-2$?

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5. If $p(x)=x^2-2\sqrt{2}x+1$, then $p\left(2\sqrt{2}\right)=$

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6. If $(x+1)$ is a factor of the polynomial $p(x)=2x^2+kx$, then k =

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7. If $(x-2)$ is a factor of x^3-3x^2+k, then k =

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8. Find the constant term in the expansion of $(x+3)^3$.

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9. Find the remainder when the polynomial $p(x)=x^{100}-x^{97}+x^3$ is divided by $x+1$.

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10. Value of $\frac{a^3+b^3+c^3-3abc}{ab+bc+ca-a^2-b^2-c^2}$, when $a=-5, b=-6, c=10$ is

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Olympiad Hots Corner

1. If $x=\frac{1}{2-\sqrt{3}}$, find the value of x^3-2x^2-7x+5

A. 2

B. 1

C. 4

D. 3

Answer: D

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2. The quotient obtained on dividing $\left(8x^4 - 2x^2 + 6x - 7\right)$ by $(2x + 1)$ is $\left(4x^3 + px^2 - qx + 3\right)$. The value of (q-p) is

A. 0

B. -2

C. 2

D. 4

Answer: C

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3. The polynomial $ax^3 - 29x^2 + 45x - 9$ when divided by $(3x - 1)$ leaves remainder 3 . Find the value of a Also, find the remainder when the given polynomial is divided by $x - 2$.

A. $3, \ -19$

B. $6, \ -11$

C. $6, 13$

D. $9, 16$

Answer: C

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4. Numbers of zeroes of the zero polynomial is

A. 0

B. 1

C. 2

D. Infinite

Answer: D

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5. If $(x+2)$ and $(2x-1)$ are factors of $\left(2x^3+ax^2+bx+10\right)$, then value of $\left(a^2+b^2\right)$ is

A. 338

B. 218

C. 74

D. 198

Answer: A

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6. Divide the product of $\left(4x^2-9\right)$ and $\left(2x^2-3x+1\right)$ by $\left(4x^3-7x+3\right)$.

A. $2x-3$

B. $2x+3$

C. $2x$

D. $3x - 2$

Answer: A

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7. If $x^4 + \frac{1}{x^4} = 47$ find the value of $x^3 + \frac{1}{x^3}$

A. 7

B. 18

C. 6

D. 12

Answer: B

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8. If $a-b=3, a+b+x=2$, then the value of $(a-b)\left[x^3+3(a+b)x^2+3x(a+b)^2+(a+b)^3\right]$ is

A. 84

B. 48

C. 32

D. 24

Answer: D

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9. If $(x+a)$ is the factor of the polynomials $\left(x^2+px+q\right)$ and $\left(x^2+mx+n\right)$, then the value of 'a' is

A. $\frac{n-q}{m-p}$

B. $\frac{m-p}{n-q}$

C. $\frac{q-n}{m-p}$

D. $\frac{m-p}{q-n}$

Answer: A

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10. Find the value of l, so that $y-2p$ is a factor of $\frac{y^3}{4p^2}-2y+lp$.

A. 0

B. 1

C. 2

D. 3

Answer: C

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11. If the polynomial $x^3 + 2x^2 - \alpha x - 12$ is divided by $(x - 4)$ the remainder is 52 . Find the value of α .

A. $11/2$

B. -5

C. 8

D. -8

Answer: C

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12. Evaluate : $(2x - y + 3z)\left(4x^2 + y^2 + 9z^2 + 2xy + 3yz - 6xz\right)$

A. $8x^3 - y^3 + 27z^3 - 18xyz$

B. $8x^3 - y^3 + 27z^3 + 18xyz$

C. $8x^3 + y^3 + 27z^3 + 18xyz$

D. $8x^3 + y^3 - 27z^3 + 18xyz$

Answer: B

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13. If $2x + 3y + z = 0$, then $\left(8x^3 + 27y^3 + z^3\right) \div xyz$ is equal to

A. 0

B. 6

C. 18

D. 9

Answer: C

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14. The value of k for which $(x-1)$ is a factor of the polynomial $x^3 - kx^2 + 11x - 6$ is

A. -6

B. 5

C. 2

D. 6

Answer: D

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15. If $x^2 + \frac{1}{x^2} = 98,$ find the value of $x^3 + 1/x^3$

A. 890

B. 970

C. 990

D. 1110

Answer: B

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16. The polynomials $\left(x^3-1\right)$ and $\left(x^2+1\right)$ are divided by $(x+1)$ leave the reminder as R_1 and R_2 respectively. The true statement among the following is

A. $R_1+R_2=0$

B. $R_1-R_2=0$

C. $2R_1+R_2=0$

D. $R_1-2R_2=0$

Answer: A

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17. Factorise : $x^4 + 5x^3 + 5x^2 - 5x - 6$

A. $\left(x^2 - 1\right)\left(x^2 + 6\right)$

B. $(x - 1)(x + 2)^3$

C. $\left(x^2 - 1\right)(x + 3)(x + 2)$

D. $(x - 1)(x + 2)\left(x^2 + 3\right)$

Answer: C

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18. The factors of $\left[\frac{2}{x^4} - \frac{1}{x^2}\right]$ will be

A. $\left(\frac{\sqrt{2}}{x^4} + \frac{1}{x}\right)\left(\frac{\sqrt{2}}{x^4} - \frac{1}{x}\right)$

B. $\left(\frac{\sqrt{2}}{x^2} + \frac{1}{x}\right)\left(\frac{\sqrt{2}}{x^2} - \frac{1}{x}\right)$

C. $\left(\frac{\sqrt{2}}{x} + \frac{1}{x}\right)\left(\frac{\sqrt{2}}{x} - \frac{1}{x}\right)$

D. None of these

Answer: B

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19. If $x = \frac{\sqrt{3}+1}{2}$, find the value of $4x^3 + 2x^2 - 8x + 7$.

A. 8

B. 10

C. 15

D. 14

Answer: B

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20. If $a + b + c = 10$ and $a^2 + b^2 + c^2 = 80$, find the value of $a^3 + b^3 + c^3 - 3abc$.

A. 700

B. 710

C. 1280

D. 950

Answer: A

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