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Class: IX
Subject: Math's
Topic: Polynomials
No. of Questions: 20

Q.1 Find the value of the polynomial at the indicated value of variable. $P(x)= 5x^2-3x+7$ at $x=1$

Solution: 9

[Explanation: $P(x)= 5x^2-3x+7$
Value of P(x) at x=1 is
$P(1)= 5(1)^2-3(1)+7$
$= 5-3+7= 9$]

Q.2 Find the zero of $P(x)= 2x+1$

Solution: $x=-1/2$

[Explanation: $P(x)= 2x+1$
Put $P(x)=0$
$2x+1=0$
$x=-1/2$]

Q.3 Find the value of $P(x)= 5x-4x^2+3$ at $x=2$

Solution: -3

[Explanation: $P(x)= 5x-4x^2+3$ at $x=2$
$P(x)= 5(2)-4(2)^2+3$
$= 10-16+3= -3$]

Q.4 Find P(2) for $P(x)=(x-1)(x+1)$

Solution: 3

[Explanation: $P(x)=(x-1)(x+1)$
$= x^2-1$
$P(2)=(2)^2-1=3$]

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Q.5 Verify whether $x=-m/l$ is the zero of $P(x)= lx+m$

Solution: Yes. $x=-m/l$ is the zero of $P(x)$

[Explanation: $P(x)= lx+m$
Putting $x=-m/l$
$P(-m/l)= l \times (-m/l)+ m=0$
Since $P(-m/l)=0$, therefore $x=-m/l$ is the zero of $P(x)$]

Q.6 Find the zero of $P(x)= ax$, $a\neq0$
Solution: 0

[Explanation: $P(x)= ax$
Putting $P(x)=0$
$ax=0$
$x=0$]

Q.7 Divide the polynomial $3x^4-4x^3-3x-1$ by $x-1$

Solution: Quotient= $3x^3-x^2-x-4$, remainder= -5

[Explanation:

$$
\begin{array}{r|l}
 & 3x^3-x^2-x-4 \\
\hline
x-1 & 3x^4-4x^3-3x-1 \\
 & 3x^4-3x^3 \\
 & -\quad + \\
\hline
 & -x^3 \quad -3x \\
 & -x^3+x^2 \\
 & +\quad - \\
\hline
 & -x^2-3x \\
 & -x^2+x \\
 & +\quad - \\
\hline
 & -4x-1 \\
 & -4x+4 \\
 & +\quad - \\
\hline
 & -5
\end{array}
$$

Q.8 Find the remainder when $x^4+x^3-2x^2+x+1$ is divided by x-1

Solution: 2

[Explanation: Let $P(x)= x^4+x^3-2x^2+x+1$ and g(x)= x-1
Zero of P(x)= 1
By remainder theorem,
$P(1)=(1)^4+(1)^3-2(1)^2+1+1$
$= 1+1-2+1+1= 4-2=2$]

Q.9 Check whether the polynomial $q(t)= 4t^3+4t^2-t-1$ is a multiple of 2t+1

Solution: Yes, as remainder=0

[Explanation: q(t) will be a multiple of 2t+1 only, if 2t+1 divides q(t) leaving remainder zero.
Now, 2t+1=0
t=-1/2
$q(-1/2)= 4 \times (-1/2)^3 + 4 \times (-1/2)^2 – (-1/2) – 1$
$= -1/2 + 1 + 1/2 - 1= 0$
Since the remainder is 0, so, q(t) is a multiple of 2t+1]

Q.10 Examine whether (x+2) is a factor of x^3+3x^2+5x+6 and of 2x+4.

Solution: Yes x+2 is a factor of both the polynomials.

[Explanation: Let $P(x) = x^3+3x^2+5x+6$ and S(x)= 2x+4
Zero of x+2 is -2
Now, $P(-2)= (-2)^3+3(-2)^2+5(-2)+6$
$= -8+12-10+6= 0$

Using factor theorem, (x+2) is a factor of P(x)
Also, S(-2)= 2(-2)+4=0
So, (x+2) is a factor of S(x)]

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Q.11 Find the value of k, if x-1 is a factor of $4x^3+3x^2-4x+k$

Solution: k=-3

[Explanation: As (x-1) is a factor of P(x)= $4x^3+3x^2-4x+k$

P(1)=0

P(1)= $4(1)^3+3(1)^2-4(1)+k$

4+3-3+k=0

K=-3]

Q.12 Factorize $6x^2+17x+5$ by splitting the middle term.

Solution: (3x+1)(2x+5)

[Explanation: $6x^2+17x+5$

$= 6x^2+15x+2x+5$

=3x(2x+5)+1(2x+5)

=(2x+5)(3x+1)]

Q.13 Factorize y^2-5y+6 by factor theorem

Solution: Let P(y)= y^2-5y+6

Factors of 6 are 1,2 and 3

Now, P(2)= $(2)^2$-5x2+6

= 4-10+6=0

(y-2) is a factor of P(y)

P(3)=$(3)^2$-5x3+6

=9-15+6=0

(y-3) is a factor of P(y)]

Q.14 Factorize $x^3-23x^2+142x-120$

Solution: (x-1)(x-10)(x-12)

[Explanation: P(x)= $x^3-23x^2+142x-120$

Factors of -120 are ±1, ±2, ±3, ±4, ±5, ±6, ±8, ±10, ±12, ±15, ±20, ±24, ±30, ±60

Put x=1

P(1)= $(1)^3-23(1)^2+142(1)-120$

= 1-23+142-120=0

(x-1) is a factor of P(x)

Now on dividing P(x) by (x-1), we get $x^2-22x+120$

$= x^2-12x-10x+120$

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= x(x-12)-10(x-12)
= (x-12)(x-10)
P(x)= (x-1)(x-10)(x-12)]

Q.15 Find the product of (x-3)(x+5)

Solution: $x^2+2x-15$

[Explanation: (x-3)(x+5)
Using identity $(x+a)(x+b)= x^2+(a+b)x+ab$
= [x+(-3)](x+5)
= $x^2+(-3+5)x+5(-3)$
= $x^2+2x-15$]

Q.16 Evaluate 105 x 106 without multiplying directly.

Solution: 11130

[Explanation: 105 x 106=(100+5)(100+6)
Using $(x+a)(x+b)= x^2+(a+b)x+ab$
$(100+5)(100+6)= (100)^2+(5+6)100+5\times6$
= 10000+ 1100+30= 11130]

Q.17 Factorize $\frac{25}{4}x^2 - \frac{1}{9}y^2$

Solution: $(\frac{5}{2}x+\frac{y}{3})(\frac{5}{2}x-\frac{y}{3})$

[Explanation: $\frac{25}{4}x^2 - \frac{1}{9}y^2$
Using $x^2-y^2= (x-y)(x+y)$
$= (\frac{5}{2}x)^2 - (\frac{y}{3})^2 = (\frac{5}{2}x+\frac{y}{3})(\frac{5}{2}x-\frac{y}{3})$]

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Q.18 Write $(3a+4b+5c)^2$ in expanded form

Solution: $9a^2 + 16b^2 + 25c^2 + 24ab + 40bc + 30ac$

[Explanation: Using identity $(x+y+z)^2= x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$
$(3a+4b+5c)^2= (3a)^2 + (4b)^2 + (5c)^2 + 2 \text{ x } 3a \text{ x } 4b + 2 \text{ x } 4b \text{ x } 5c + 2 \text{ x } 5c \text{ x } 3a$
$= 9a^2 + 16b^2 + 25c^2 + 24ab + 40bc + 30ac$]

Q.19 Factorize $4x^2 + y^2 + z^2 - 4xy -2yz + 4xz$

Solution: $(2x-y+z)^2$

[Explanation: $4x^2 + y^2 + z^2 - 4xy -2yz +4xz$
$= (2x)^2 + (-y)^2 + (z)^2 - 2 *2x * y - 2 * y * z + 2 z * 2x$
$= (2x-y+z)^2$]

Q.20 Write the cube in expanded form $(5p-3q)^3$

Solution: $125p^3 - 27q^3 - 225p^2q + 135pq^2$

[Explanation: $(5p-3q)^3$
Using identity $(a-b)^3= a3 - 3ab(a-b) - y^3$
$(5p-3q)^3 = (5p)^3 - 3 \text{ x } 5p \text{ x } (3q) \text{ x } (5p-3q) - (3q)^3$
$= 125p^3 - 27q^3 - 225p^2q + 135pq^2$]

Q.21 Evaluate $(999)^3$

Solution: 997002999

[Explanation: $(999)^3 = (1000-1)^3$
$= (1000)^3 - (1)^3 - 3 \text{ x } 1000 \text{ x } 1(1000-1)$
$= 1000000000 - 1 - 3000000 + 3000= 997002999$]

Q.22 Factorize $2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8xz$

Solution: $(-\sqrt{2}x + y + 2\sqrt{2}z)^2$

[Explanation: $2x^2 + y^2 + 8z^2 - 2\sqrt{2}xy + 4\sqrt{2}yz - 8xz$

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$= (-\sqrt{2})^2 + (y)^2 + (2\sqrt{2}z)^2 - 2 \times (-\sqrt{2}x) \times y + 2 \times y \times 2\sqrt{2}z - 2 \times (-\sqrt{2}x) \times 2\sqrt{2}z$

$= (-\sqrt{2}x + y + 2\sqrt{2}z)^2$]

Q.23 Factorize $8x^3 + y^3 + 27z^3 - 18xyz$

Solution: $(2x + y + 3z)(4x^2+y^2+9z^2-2xy-3yz-6xz)$

[Explanation: Using identity $x^3+y^3+z^3-3xyz= (x+y+z)(x^2+y^2+z^2-xy-yz-zx)$

$8x^3 + y^3 + 27z^3 - 18xyz= (2x + y + 3z)(4x^2+y^2+9z^2-2xy-3yz-6xz)$]

Q.24 Factorize $64m^3-343n^3$

Solution: $(4m-7n)(16m^2 + 49n^2 + 28mn)$

[Explanation: $64m^3-343n^3$

Using identity $(x-y)^3= x^3-y^3-3xy(x-y)$

$64m^3-343n^3= (4m)^3-(7n)^3= (4m-7n)^3 + 3(4m)(7n)(4m-7n)$

$= (4m-7n)((4m-7n)^2 + 3(4m)(7n)$

$= (4m-7n)(16m^2 + 49n^2 + 28mn)$]

Q.25 Find the value of $(-12)^3+(7)^3+(5)^3$ without actually calculating cubes.

Solution: -1260

[Explanation: Here, x= -12, y=7, z=5

$x+y+z= (-12) + 7 + 5=0$

⇨ $x^3+y^3+z^3=3xyz$

$(-12)^3+(7)^3+(5)^3= 3x(-12)x7x5=-1260$]