POLYNOMIALS

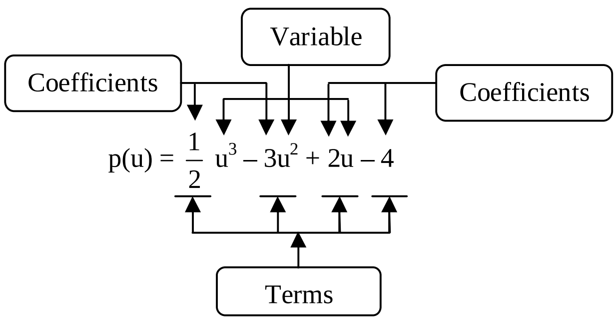
POLYNOMIAL IN ONE VARIABLE

An algebraic expression of the form $p(x) = a_nx^n + a_{n-1}x^{n-1} + a_{n-2}x^{n-2} + ... + a_1x^1 + a_0x^0$, where

(i) $an \neq 0$

(ii) power of x is whole number, is called a polynomial in one variable.

Hence, an, a_{n-1}, a_{n-2}, ..., a_0 are coefficients of x_n, x_{n-1}, ..., x_0 respectively and a_nx^n, $a_{n-1}x^{n-1}$, $a_{n-2}x^{n-2}$, ... are terms of the polynomial. Here the term a_nx^n is called the ***Leading term*** and its coefficient an, the leading coefficient.



ZERO POLYNOMIAL

Constants 2, –2, $f\left(\frac{2}{3}\right) = 3\left(\frac{2}{3}\right) - 2 = 0$, $\frac{3}{2}$ and a can be written as $2x^0$, $-2x^0$, $\sqrt{2}\,x^0$, $\frac{3}{2}x^0$, x 2 and ax^0 respectively. Therefore, these Constants are expressed as polynomials which contain single term in variable x and the exponent of the variable is 0. Thus, we can define a constant as a constant polynomial. In particular, the constant number 0 as the zero polynomial.

DEGREE OF POLYNOMIALS

Degree of the polynomial in one variable is the largest exponent of the variable. For example, the degree of the polynomial $3x^7 - 4x^6 + x + 9$ is 7 and the degree of the polynomial 5x6 – 4x2 – 6 is 6. Polynomials classified by degree.

Degree	Name	General Form	Example
(undefined)	Zero Polynomial	0	0
0	Non-zero) constant polynomial	$a;\ (a \neq 0)$	1
1	Linear polynomial	$ax + b;\ (a \neq 0)$	$x + 1$
2	Quadratic Polynomial	$ax^2 + bx + c;$ $(a \neq 0)$	$x^2 + 1$
3	Cubic polynomial	$ax^3 + bx^2 + cx + d;\ (a \neq 0)$	$x^3 + 1$

Usually, a polynomial of degree n, for n greater than 3, is called a polynomial of degree n, although the phrases quartic polynomial and quantic polynomial are sometimes used.

SOME SPECIAL TYPES OF POLYNOMIALS

Monomials : Polynomials having only one term are called monomials.

E.g. 2, 2x, $7y^5$, $12t^7$etc.

Binomials : Polynomials having exactly two dissimilar terms are called binomials.

E.g. $p(x) = 2x + 1$, $r(y) = 2y^7 + 5y^6$ etc.

Trinomials : Polynomials having exactly three distinct terms are called trinomials.

E.g. $p(x) = 2x^2 + x + 6$, $q(y) = 9y^6 + 4y^2 + 1$ etc.

ZEROS / ROOTS OF A POLYNOMIAL / EQUATION

Consider a polynomial $f(x) = 3x^2 - 4x + 2$. If we replace x by 3 everywhere in the above expression, we get

$f(3) = 3 \times (3)^2 - 4 \times 3 + 2 = 27 - 12 + 2 = 17$.

We can say that the value of the polynomial f(x) at x = 3 is 17.

Similarly, the value of polynomial

$f(x) = 3x^2 - 4x + 2$ at $x = -2$ is $f(-2) = 3(-2)2 - 4 \times (-2) + 2 = 12 + 8 + 2 = 22$

at x = 0 is $f(0) = 3(0)^2 - 4(0) + 2 = 0 - 0 + 2 = 2$

at $x = \frac{1}{2}$ is

$$f\left(\frac{1}{2}\right) = 3\times\left(\frac{1}{2}\right)^2 - 4\times\left(\frac{1}{2}\right) + 2 = \frac{3}{4} - 2 + 2 = \frac{3}{4}$$

In general, we can say $f(\alpha)$ is the value of the polynomial f(x) at $x = \alpha$, where α is are a real number. A real number α is zero of a polynomial f(x) if the value of the polynomial f(x) is zero at $x = \alpha$ i.e. $f(\alpha) = 0$.

OR

The value of the variable x, for which the polynomial f(x) becomes zero is called zero of the polynomial.

E.g. : consider, a polynomial $p(x) = x^2 - 5x + 6$; replace x by 2 and 3.

$p(2) = (2)^2 - 5 \times 2 + 6 = 4 - 10 + 6 = 0$,

$p(3) = (3)^2 - 5 \times 3 + 6 = 9 - 15 + 6 = 0$

$\therefore$ 2 and 3 are the zeros of the polynomial p(x).

ROOTS OF A POLYNOMIAL EQUATION

An expression f(x) = 0 is called a polynomial equation if f(x) is a polynomial of degree $n \geq 1$.

A real number α is a root of a polynomial f(x) = 0 if $f(\alpha) = 0$ i.e. α is a zero of the polynomial f(x).

E.g. consider the polynomial $f(x) = 3x - 2$, then $3x - 2 = 0$ is the corresponding polynomial equation.

Here, $f\left(\frac{2}{3}\right) = 3\left(\frac{2}{3}\right) - 2 = 0$ f

i.e. $\frac{2}{3}$ is a zero of the polynomial $f(x) = 3x - 2$ or

$\frac{2}{3}$ is a root of the polynomial equation $3x - 2 = 0$

Operation on Polynomials

(1) Adding/Subtracting Polynomials

We combine like terms as before.

Beware: minus signs and parentheses

(i) Find $(6x^2 - 4x - 3) + (3x^2 + 4)$

$\boxed{9x^2 - 4x + 1}$

(ii) Find $(5x^3 + 3x - 2) - (6x^2 - 4x + 2)$

$5x^3 + 3x - 2 - 6x^2 + 4x - 2$

$= \boxed{5x^3 - 6x^2 + 7x - 4}$

(2) Multiplying Polynomials By Monomials

A monomial is a one-term polynomial. Use the distributive property

Find $6x^3y\,(2xy - 7x + 8y^2)$

$\boxed{(12x^4 y^2 - 42x^4 y + 48x^3y^3)}$

(3) Multiplying Binomials

A binomial is a two-term polynomial.

Method 1: Distributive Property

If the problem is to expand $(6x - 4y)(x^2 + 3y)$, we distribute the $(6x - 4y)$ to the two terms of the second binomial :

$$(6x - 4y)(x^2 + 3y) = (6x - 4y)x^2 + (6x - 4y)3y$$

Now use the distributive property again to get $(6x^3 - 4x^2 y + 18xy - 12y^2)$

A shortcut to the above method is called FOIL.

Method 2: FOIL

FOIL is an acronym for "First-Outer-Inner-Last"

Consider the following example:

Find $(5x + 2y)(6x - y)$ using Foil

First: $(5x)(6x) = 30x^2$

Outer: $(5x)(-y) = -5xy$

Inner: $(2y)(6x) = 12y$

Last: $(2y)(-y) = -2y$

Thus we get

$30x^2 - 5xy + 12xy - 2y^2$

$= \boxed{30x^2 + 7xy - 2y^2}$

(4) Multiplying Polynomials of Any Size

Method 1: Distributive Property

If the problem is to expand $(3x^2 - 4x + 4)(x^2 + 2x - 3)$, we distribute the $(3x^2 - 4x + 4)$ to the terms of the second polynomial:

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

$$= (3x^2 - 4x + 4)x^2 + (3x^2 - 4x + 4)2x + (3x^2 - 4x + 4)(-3)$$

Now use the distributive property again

$$3x^2 - 4x^3 + 4x^2 + 6x^3 - 8x^2 - 9x^2 + 12x - 12$$

Thus, after combining like terms, we get

$(3x^2 + 2x^3 - 13x^2 + 20x - 12)$

A shortcut to the above method is called the factor table

Method 2: Factor Table

You make a "tic-tac-toe" grid, and fill in the boxes with the products.

Consider $(2x^2 y - 4y^2 + x^2)(3xy + xy^2 - 4)$

Make factor table:

	$2x^2 y$	$-4y^2$	x^2
$3xy$			
$+xy^2$			
-4			

Then fill in the table with the products:

	$2x^2 y$	$-4y^2$	x^2
$3xy$	$+6x^3 y^2$	$-12xy^3$	$+3x^3 y$
$+xy^2$	$+2x^3 y^3$	$-4xy^4$	$+x^3 y^2$
-4	$-8x^2 y$	$+16y^2$	$-4x^2$

Collecting like terms:

$$\boxed{7x^3 y^2 - 12xy^3 + 3x^3 y + 2x^3 y^3 - 4xy^4 - 8x^2 y + 16y^2 - 4x^2}$$

WORK SHEET

1. What type of equation is the following ?

(y + 2) (y + 4) (y + 1) = z

(a) Constant (b) Cubic

(c) quadrtic (d) quartic

2. Find the degree of the polynomial:

$5x^3 + x2y^6 + 7y^4$

(a) 12 (b) 6

(c) 15 (d) 8

3. What is the degree of the following polynomial?

$2m^3n + 7mn + 14$

(a) 3 (b) 14

(c) 2 (d) 4

4. What is $\frac{x^2 - x - 30}{x^2 - 4x - 12}$ equal to ?

(a) $\frac{x-5}{x-2}$ (b) $\frac{x-6}{x-2}$

(c) $\frac{x+5}{x-6}$ (d) $\frac{x+5}{x+2}$

5. Simplify:

$\frac{x^2+8x-9}{x^2-6x+5}$

(a) $\frac{x-1}{x+5}$ (b) $\frac{x+9}{x-5}$

(c) $\frac{8x-9}{-6x+5}$ (d) $\frac{x-9}{x-1}$

6. Simplify the following division of polynomials:

$\frac{x^3+3x+3}{x+1}$

It cannot be simplified any further.

(a) $x + 2 + \frac{1}{1+x}$

(b) $x + 3$

(c) $x + \frac{3}{x+1}$

7. Expand:

$(x^2 + 5)(x^2 + 2x + 5)$

$x^4 + 2x^3 + 10x^2 + 10x + 25$

(a) $5x^2 + 10x$

(b) $x^4 + 2x^3 + 5x^2 + 25$

(c) $x^4 + 2x^3 + 10$

8. Two positive consecutive whole numbers that are even are both multiples of 6. The product of the two numbers is 72.

What is the sum of the two integers ?

(a) 18 (b) 12

(c) – 18 (d) 6

9. Multiply these polynomials out and expand. $(5x^2 + 2x + 5)(x+3)$

(a) $5x^3 + 17x^2 + 11x + 15$

(b) $15x^3 + 6x^2 + 15x$

(c) $5x^2 + 3x + 8$

(d) $5x^3 + 2x^2 + 5x + 15$

10. Simplify:

$(4x^2 - 6x^5 - 2) - (x^5 + 3x^3 - 4x^2 - 2)$

(a) $-\ 7x^5 + 3x^3 - 4$

(b) $-\ 7x^5 - 3x^3 + 8x^2 - 4$

(c) $-7x^5 + 3x^3 - 8x^2$

(d) $-5x^5 + 3x^2 - 4$

11. Simplify:

$3x^2 + 5x + 10 - (10x^2 - 15x - 3)$

(a) $-17x^2 + 7$

(b) $3x^2 + 5x + 7$

(c) $-7x^2 - 10x + 7$

(d) $-7x^2 + 20x + 13$

12. If $f(x) = 2x^2 - 3$, then what does $f(x + a)$ equal ?

Possible Answers:

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

(b) $4x^2 + 8ax + 4a^2 - 3$

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

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

13. The expression $a[(b - c) + d]$ is equivalent to which of the following?

(a) ab + ac – ad (b) b – c + ad

(c) ab + ac + ad (d) ab – ac + ad

14. Solve the equation $x^2-25x=0$

(a) 25 (b) – 5

(c) 5 (d) 10

15. Simplify the following expression.

$(2x^3 + 6x^2 - 3x + 1) + (x^3 - 2x^2 + 4x - 3)$

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

(b) $3x^3 + 4x^2 + x - 2$

(c) $2x^3 + 6x^2 + 2x + 2$

(d) $3x^3 + 2x^2 + 2x + 2$

16. What is the value of x when $5x - 5y = 5y - 5x$

(a) $25x = y$ (b) $25y = x$

(c) $x + y = 0$ (d) $x = y$

17. Add the following polynomials:

$(5x^3 + 31x^2-17x-6)+(-2x^3+9x^2 +34x -12)$

(a) $7x^3 + 40x^2 + 17x - 18$

(b) $3x^3 + 40x^2 + 17x - 18$

(c) $3x^3 +22x^2 + 10x - 18$

(d) $3x^3 + 40x^2 -17x + 6$

18. What is the value of the coefficient in front of the term that includes x^2y^7 in the expansion of $(2x - y)^9$?

(a) – 144 (b) – 36

(c) 36 (d) 144

19. A function of the form $f(x) = ax^2 + b$ passes through the points (0, 7) and (−2,19). What is the value of a ?

(a) 3 (b) – 2

(c) 7 (d) 2

20. $2x^2 \cdot x^3y^2 \cdot 3y$ is equivalent to which of the following?

(a) $6x^6y^2$ (b) 6xy

(c) $5x^6y^2$ (d) $6x^5y^3$

ANSWER SHEET

Sol.1 (b) Cubic

Explanation: The degree of a polynomial is the highest exponent of the terms.

Degree 0 – constant

Degree 1 – linear

Degree 2 – quadratic

Degree 3 – cubic

Degree 4 – quartic

Multiply out the equation:

$(y + 2)(y + 4)(y + 1) = z$

$(y^2 + 2y + 4y + 8)(y + 1) = z$

$y^3 + 2y^2 + 4y^2 + 8y + y^2 + 2y + 4y + 8 = z$

The highest exponent is y^3; therefore the equation is a degree 3 cubic.

Sol.2 (d) 8

Explanation: The degree of a polynomial is determined by the term with the highest degree. In this case that is x^2y^6, which has a degree of 8.

Sol.3 (d) 4

Explanation: The degree of a polynomial is determined by the term with the highest degree. In this case, the first term, $2m^3n$, has the highest degree, 4. The degree of a term is calculated by adding the exponents of each variable in the term.

Sol.4 (d) $\frac{x+5}{x+2}$

Explanation:

1. **Factor the numerator:**

   $x^2 - x - 30 = (x + 5)(x - 6)$

2. Factor the denominator:

   $x^2 - 4x - 12 = (x - 6)(x + 2)$

3. Divide the factored numerator by the factored denominator:

$$\frac{(x+5)(x-6)}{(x-6)(x+2)}$$

You can cancel out the $x - 6$ from both the numerator and the denominator, leaving you with:

$$\frac{x+5}{x+2}$$

Sol.5 (b) $\frac{x+9}{x-5}$

Explanation: In order to divide these polynomials, you need to first factor them.

$x^2 + 8x - 9 = (x + 9)(x - 1)$

and

$x^2 - 6x + 5 = (x - 1)(x - 5)$

Now, the expression becomes

$$\frac{(x+9)(x-1)}{(x-5)(x-1)}$$

$$\frac{(x-1)}{(x-1)} = 1$$

so, $\frac{(x+9)(x-1)}{(x-5)(x-1)}$

$$= \frac{(x+9)}{(x-5)}$$

Sol.6 (a) $x + 2 + \frac{1}{x+1}$

Explanation: The leading term of the numerator is one exponent higher than the leading term of the denominator.

Thus, we know the result of the division is going to be somewhere close to $\frac{x^2}{x} = x$.

We can separate the fraction out like this:

$$\frac{x^2+3x+3}{x+1} = \frac{x^2+x}{x+1} + \frac{2x+3}{x+1}$$

The first term is easily seen to be $\frac{x(x+1)}{(x+1)}$, which is equal to x.

The second term can also be written out as:

$$\frac{2x+2}{x+1} + \frac{1}{x+1} = \frac{1}{x+1}$$

and combining these, we get our final answer, $x + 2 + \frac{1}{x+1}$.

Sol.7 (a) $x^4 + 2x^3 + 10x^2 + 10x + 25$

Explanation: Expand

$(x^2 + 5)(x^2 + 2x + 5)$

Step 1: Use the distributive property

$x^2(x2 + 2x + 5) + 5(x2 + 2x + 5)$

$x^4 + 2x^3 + 5x^2 + 5x^2 + 10x + 25$

Step 2: Combine like terms

$x^4 + 2x^3 + 10x^2 + 10x + 25$

Sol.8 (a) 18

Explanation: The question provides two positive whole numbers that are each multiples of 6 and also 6 numbers apart. This may be translated into variables, where the first number may be represented by "x" and the second number may be represented as "x + 6" given that it is 6 numbers greater than x.

The problem provides the information that the product of these two numbers is 72. Using the new definitions for the numbers, this may be represented as:

$$(x)(x+6) = 72$$

This provides an equation that multiplies two polynomials (one with one term, which is a monomial and one with two terms, which is a binomial) and an ability to solve for what x (the first of the two numbers) may be.

Using FOIL, the result is $x^2 + 6x = 72$. This may be rewritten as $x^2 + 6x – 72 = 0$, which will provide the value of x after factoring.

$(x + 12)(x − 6) = 0$, where (–6)(12) will provide the product of –72 and the sum of 12 and –6 will yield 6. The results indicate x as having two possible solutions: x = 6 and x = – 12. Returning back to the question, the goal is to find two positive numbers. This means that x = –12 is not a viable solution and that x = 6 is.

Now, revisiting the terms used to redefine the two numbers [x and x + 6], x has been calculated. After substituting in the x value for the second term, the second number is 12 (6 + 6 = 12).

The final step of the problem is to solve for the sum of these two numbers: 6 + 12 = 18

Sol.9 (a) $5x^3 + 17x^2 + 11x + 15$

Explanation: The proper way to multiply polynomials is to essentially apply the distributive property continually.

So $(5x^2 + 2x + 5)(x + 3)$ is really the same as $(5x^2 + 2x + 5)\cdot x + (5x^2 + 2x + 5)\cdot 3$, and so on.

$(5x^2 + 2x + 5)(x + 3) = x(5x^2 + 2x + 5) + 3(5x^2 + 2x + 5)$

$5x^3 + 2x^2 + 5x + 15x^2 + 6x + 15$

Then, simply group together like terms to get the final answer:

$5x^3 + 17x^2 + 11x + 15$

Sol.10 (c) $– 7x^5 – 3x^3 +8x^2$

Explanation: When subtracting polynomials, it's helpful to remember that the "minus sign" gets distributed. It's as if the two polynomials are being added and a – 1 is in front of the second polynomial.

$(4x^2 − 6x^5 − 2) + (−1)(x^5 + 3x^3 − 4x^2 − 2)$

This -1 will get multiplied to all the terms in the second polynomial that is being subtracted from the first, so it becomes $(−x^5 − 3x^3 + 4x^2 + 2)$. You may note that by multiplying by -1, every term in the polynomial switches its original sign. The problem then becomes:

$(4x^2 − 6x^5 − 2) + (−x^5 − 3x^3 + 4x^2 + 2)$

From here, in order to simplify, because there's no equal sign, it can be deduced that we are not working toward a solution for x. The original problem is presented as an expression so an expression as an answer will be expected. In order to work towards a final simplified expression, like terms must be collected. This will provide the final answer.

$4x^2 − 6x^5 – 2 + − x^5 − 3x^3 + 4x^2 + 2 −7x^5 − 3x^3 + 8x^2$

Sol.11 (d) $−7x^2 + 20x + 13$

Explanation: Begin by distributing the subtraction of the second term in this question:

$3x^2 + 5x + 10 − 10x^2 + 15x + 3$

Now, you merely need to combine like terms:

$3x^2 − 10x^2 + 5x + 15x + 10 + 3 − 7x^2 + 20x + 13$

Sol.12 (c) $2x^2 + 4ax + 2a^2 − 3$

Explanation: To solve this equation, we substitute (x + a) in for every instance of x seen in the original equation $f(x) = 2x^2 − 3$. Therefore the new equation would read

$f(x) = 2x^2 – 3 \rightarrow f(x + a) = 2(x + a) 2 − 3$

Now we must square the expression x + a. To do this, you must multiply the expression by itself. Therefore:

$(x + a)^2 = (x + a)\cdot(x + a)$

$(x + a)\cdot(x + a) = (x\cdot x) + (x\cdot a) + (x\cdot a) + (a\cdot a)$

$(x\cdot x) + (x\cdot a) + (x\cdot a) + (a\cdot a) = x^2 + 2ax + a^2$

We must now plug in our new value for $(x + a)^2$ into our original equation in place of x^2.

$f(x) = 2(x^2 + 2ax + a^2) − 3$

Now we must distribute the 2 into $(x^2 + 2ax + a^2)$. To do this, you multiply each expression within the parenthesis by 2:

$2(x^2 + 2ax + a^2) = 2x^2 + 4ax + 2a^2$

Therefore, our answer is $f(x) = 2x^2 + 4ax + 2a^2 − 3$.

Sol.13 (d) ab – ac + ad

Explanation: To answer this question, we must distribute the a to the rest of the variables b, c, and d that are within the brackets.

To distribute a variable or number, you multiply that value with every other value within the brackets or parentheses. So, for this data:

a[(b − c) + d] = [[(a·b) − (a·c)] + (a·d)]

We then simplify the expression by combining the variables we are multiplying together into expressions. For this data:

[[(a·b) − (a·c)] + (a·d)] = ab – ac + ad

Be sure to keep all of your operations the same within the problem itself, unless the number being distributed is negative, which will then switch the signs with the brackets from positive to negative or negative to positive.

Therefore, our answer is ab – ac + ad.

Sol.14 (a) 25

Explanation: To answer this question, we are solving for the values of x that make this equation true.

To this, we need to get x on a side by itself so we can evaluate it.

To do this, we first add 25x to both sides so that we can then begin to deal with the x^2 value. So, for this data:

$$x^2 - 25x = 0 \rightarrow x^2 = 25x$$

x^2 can also be written as x·x.

Therefore:

$$x^2 = 25x \rightarrow x \cdot x = 25x$$

Now we can divide both sides by x and find the value of x.

$$x \cdot xx = 25xx \rightarrow x = 25$$

Therefore, the answer to this question is x = 25

Sol.15 (b) $3x^3 + 4x^2 + x - 2$

Explanation: Line up each expression vertically. Then combine like terms to solve.

$2x^3 + 6x^2 - 3x + 1$

$x^3 - 2x^2 + 4x - 3$

$2x^3 + x^3 = 3x^3$

$6x^2 - 2x^2 = 4x^2$

$-3x + 4x = x$

$1 - 3 = -2$

Thus, the final solution is $3x^3 + 4x^2 + x - 2$

Sol.16 (d) x = y

Explanation:

5x − 5y = 5y − 5x

In adding 5x to both sides:

5x − 5y + 5x = 5y − 5x + 5x

10x − 5y = 5y

. . . and adding 5y to both sides:

$$10x - 5y + 5y = 5y + 5y$$

. . . the variables are isolated to become:

$$10x = 10y$$

After dividing both sides by 10, the equation becomes:

x = y

Sol.17 (b) $3x^3 + 40x^2 + 17x - 18$

Explanation: This is a problem where elimination can be help you save a little time. You can eliminate options quickly by simplifying one power at a time and comparing your work with the answer choices.

To begin, reorder the problem so that all like terms are next to each other.

When doing so, keep an eye on your signs so that you don't accidentally make a mistake.

$(5x^3 - 2x^3) + (31x^2 + 9x^2) + (-17x + 34x) + (-6 - 12)$

From here, combine each pair of terms. As you do so, compare your work with the answer choices.

$$(5x^3 - 2x^3) = 3x^3$$

Eliminate any answer choices that have a different x^3x^3 term.

$$(31x^2 + 9x^2) = 40x^2$$

Eliminate any answer choices that have a different x^2 term.

$(-17x + 34x) = 17x$ Eliminate any answer choices that have a different x term.

$(-6 - 12) = -6 + -12 = -18$ Eliminate any answer choices that have a different constant term.

Once you put all of your solutions together, the correct answer looks like this:

$$3x^3 + 40x^2 + 17x - 18$$

Sol.18 (a) −144

Explanation: Using the binomial theorem, the term containing the $x^2\ y^7$ will be equal to

$$\binom{9}{7}(2x)^2(-y)^7 = 36(-4x^2\ y^7) =$$

$$-144x^2y^7$$

Sol.19 (a) 3

Explanation: The easiest way to solve for a is to begin by plugging each pair of coordinates into the function.

Using our first point, we will plug in 0 for x and 7 for f(x).

This gives us the equation $7 = a(0)^2 + b$.

Squaring 0 gives us 0, and multiplying this by a still gives 0, leaving only b on the right side, such that 7 = b.

We now know the value of b, and we can use this to help us find a. Substituting our second set of coordinates into the function, we get

$$19 = a(-2)^2 + b$$

which simplifies to 19 = 4a + b.

However, since we know b = 7, we can substitute to get 19 = 4a + 7

subtracting 7 from both sides gives 12 = 4a and dividing by 4 gives our answer 3 = a.

Sol.20 (d) $6x^5y^3$

Explanation: To answer this problem, we need to multiply the expressions together, being mindful of how to correctly multiply like variables with exponents. To do this, we add the exponents together if the like variables are being multiplied and subtract the exponents if the variables are being divided. So, for the presented data:

$$2x^2 \cdot x^3y^2 \cdot 3y = 2x^5 \cdot 3y^3$$

We then multiply the remaining expressions together.

When we do this, we will multiply the coefficients together and combine the different variables into the final expression. Therefore: $2x^5 \cdot 3y^3 = 6x^5y^3$

This means our answer is $6x^5y^3$.