# UNIT 6: ALGEBRA AND POLYNOMIALS

**Exercise 1:** Express the following statements using algebraic language:

a) The double of a number minus seventeen
b) The sum of a number and its cube
c) The difference of the squares of two numbers
d) Three consecutive numbers
e) The product of a number and its square
f) The division of a number and the previous one
g) The product of six numbers
h) The triple of the cube of a number plus seven times the number squared
i) The square of the difference of two numbers
j) The fifth root of the sum of three numbers

**Exercise 2:** Find the coefficient, the variable part and the degree of these monomials:

a) $x^5y^2$ b) $-2a^2b^3c^4$ c) $\frac{3}{7}v$

d) $s$ e) $-7$ f) $x+y$

**Exercise 3:** Work out:

a) $12x-2x-7x+x=$
b) $2x^2-5x^2-x^2+3x^2=$
c) $3x-2x^2-7x^2+x+3x^2-9x=$
d) $x^2-5x+6-2x^2-7x-1=$
e) $a^2b-3ab^2+8ab^2-5a^2b=$
f) $a+2b+3c-2a-3b-4c=$
g) $uv+vw+uw+uv-uw=$

**Exercise 4:** Work out:

a) $4(x+5)-2(x+2)=$
b) $5(2x+3)-3(x-2)=$
c) $7(4-2x)-(x-1)=$
d) $-8(6x+5)-2(9x+3)=$

**Exercise 5:** Multiply and divide these monomials:

a) $3x^2\cdot x\cdot(-7x^5)=$ b) $(7x^2yz^7)\cdot(-2x^5z^2)=$
c) $(18x^2y^4):(9xy^2)=$ d) $(3u^3v^2w^5):(12uw^4)=$
e) $(a^2b^5c)\cdot(2ab)=$ f) $(14w^7):(2w^6)=$

**Exercise 6:** Evaluate these polynomials in given values of the variables:

a) $P(x)=x^3-3x^2+8x-1$ when $x=2$ ; $x=3$

b) $Q(a,b)=5ab+2a-3b$ when $a=1,\ b=-2$ and $a=2,\ b=-1$

c) $C(a,b)=ab^2+5a-7$ when $a=1,\ b=2$ and $a=0,\ b=-5$

d) $R(x)=x^3+2x^2-5x$ when $x=1$ ; $x=-2$ ; $x=0$

e) $S(x)=x^3-7x^2+2x-1$ when $x=2$ ; $x=-1$

**Exercise 7:** Given the polynomials:

$P(x)=5x^6-4x^5+3x^2-8x+9$

$Q(x)=7x^6+2x^5-8x^4+5x-10$ ,

$R(x)=-8x^6+5x^5-7x^3-4x^2+5x$

Work out:

a) $P+Q=$ b) $P+R=$

c) $R-Q=$ d) $P-R=$

**Exercise 8:** Given the polynomials:

$P(x)=3x^4-2x^3-8x+7$

$Q(x)=-7x^4+x^3-5x^2-9$

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

Work out:

a) $P+Q=$ b) $P-Q=$

c) $P-Q-R=$ d) $Q+R=$

**Exercise 9:** Work out:

a) $(2x^2+x+1)(x-3)=$

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

c) $(7x^3y^2-x^2y+3x^2y^2)(xy-x)=$

d) $(7x-11)(7x+11)=$

e) $(2xz^3-5x^2z-x)(x-z)=$

f) $x\,(x-7)-x\,(x-2)=$

g) $(2x+5)(2x+5)=$

**Exercise 10:** Given the polynomials: $P(x)=2x^2-8x+7$ , $Q(x)=5x^2-9$ and $R(x)=3x-5$ work out:

a) $P\cdot Q=$

b) $P\cdot R=$

c) $Q\cdot R=$

**Exercise 11:** Take out all the common factors:

a) $x^4-3x^3+5x^2+7x=$

b) $x^7-5x^6+8x^4-3x^3=$

c) $14x^3y^4+21xy^6-35x^7y^2=$

d) $12x^4y-16x^3y^3+10x^2y^5=$

e) $5u^3v^2-10u^4v^2+20u^5v^3z=$

f) $81a^3b^7-3a^2b+12a^8bc-63a^4b^5=$

**Exercise 12:** Take out all the common factors:

a) $28x^2yz-42xy^2z+56xyz^2=$

b) $9x^5-12x^4+6x^3=$

c) $x^3yz^2+x^2y^3z^4-xy^2z^3+xyz^2=$

d) $10v^4w^2-25v^3w^4-5v^2w^4+15v^4w^5=$

e) $25x^5y^2z^3-5x^2yz^3+10x^3y^3z^4+15x^6y^7z^8=$

f) $24a^3b^2c^2+30a^2b^4c^2+36a^2b^2c^5=6a^2b^2c^2\,(4a+5b^2+6c^3)$

**Exercise 13:** Expand these expressions using quadratic multiplication formulas:

a) $(x+1)^2=$

b) $(a+9)(a-9)=$

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

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

e) $(7+3zy^2)^2=$

f) $(3-5x^3y^7)(3+5x^3y^7)=$

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

h) $(x+2y)(x-2y)=$

i) $(7a+b)(7a-b)=$

j) $(cx+dy)^2=$

**Exercise 14:** Expand these expressions using quadratic multiplication formulas:

a) $(a^2-b^4)^2=$

b) $(abc+d^7)(abc-d^7)=$

c) $(3u^2-w^7)^2=$

d) $(u^2v^3-w^6)^2=$

e) $(8x+5y)(8x-5y)=$

f) $(2x^2y-4x^3z^5)^2=$

**Exercise 15:** Express using quadratic multiplication formulas:

a) $x^2-14x+49=$

b) $x^2-4=$

c) $y^{10}+12y^5+36=$

d) $4a^2-b^2=$

e) $4x^2-20xy+25y^2=$

f) $x^2-8xy^3+25y^6=$

g) $a^2+10a-25=$

h) $36x^{12}y^8z^4-60x^6y^4z^2a^2b^5+25a^4b^{10}=$

**Exercise 16:** Factor these expressions:

a) $4x^3 - 12x^2 + 9x =$

b) $x^6 z - 25x^2 z =$

c) $x^{13} y - 4x^7 y^2 + 4xy^3 =$

d) $98a^2 + 112ab + 32b^2 =$

**Exercise 17:** Given the polynomials:

$P(x) = 7x^4 - 3x^2 + 2x - 5$

$Q(x) = -3x^4 - 7x^3 + 5x - 9$

$R(x) = 4x^2 - x$

Work out the value of the following operations:

a) $P + Q =$

b) $P - Q =$

c) $2Q - 3R =$

d) $P \cdot R =$

**Exercise 18:** Expand these expressions using quadratic multiplication formulas:

a) $(x - 11)^2 =$

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

c) $(8x - 7)(8x + 7) =$

d) $(2x^5 y^7 v^4 - x^6 v)^2 =$

**Exercise 19:** Work out the numerical value of the following polynomials:

a) $P(x) = x^3 - 2x^2 + 8x - 1$ when $x = 3$

b) $Q(a,b) = 5ab + 2a - 3b - b^2$ when $a = 2,\ b = -1$

**Exercise 20:** Simplify the trinomial $27a^5 b + 90a^3 b^4 + 75ab^7$, taking out common factors and using quadratic multiplication formulas.