NCERT Class 9 Maths - Chapter 2
Polynomials: Exercise Solutions (Medium-detailed)

Q1. Which of the following - 4x^2 - 3x + 7

Answers & reasons:
(i) 4x^2 - 3x + 7 — Polynomial in one variable (all exponents whole numbers).
(ii) y^2 + 2 — Polynomial (single variable y, exponent 2).
(iii) 3/2 t + t^2 — Not a polynomial if written as 3/2 t + t^2? (3/2·t is fine) Actually 3/2·t + t^2 is polynomial in t (c
(iv) y + 2/y — Not a polynomial (term 2/y = 2·y^(-1) has negative exponent).
(v) x^{10} + y^3 + t^{50} — Not a polynomial in one variable (more than one variable).

Q2. Write the coefficients of x^2 - each - listing ends

(i) 2 + x^2 + x — coefficient of x^2 is 1.
(ii) 2 - x^2 + x^3 — coefficient of x^2 is -1.
(iii) x^2 + x^2/π ? — interpreting 2/π x^2 + x? If expression is (π + x^2?) — from text coefficient of x^2 is 1 or as
(iv) 2 1 x^{-?} — unclear; if term x^{-1} present, coefficient of x^2 is 0.
(Short answer: extract coefficient by inspecting term multiplied by x^2.)

Q3. Give one example each - binomial of degree 35

Example: Binomial degree 35: x^{35} + 1. Monomial degree 100: 7x^{100}.

Q4. Write the degree of each - list ends

(i) 5x^3 + 4x^2 + 7x — degree 3.
(ii) 4 - y^2 — degree 2.
(iii) 5t - 7 — degree 1.
(iv) 3 — degree 0.

Q5. Classify the following as - linear, quadratic and cubic

(i) x^2 + x — quadratic.
(ii) x - x^3 — cubic (degree 3).
(iii) y + y^2 + 4 — quadratic.
(iv) 1 + x — linear.
(v) 3t — linear.
(vi) r^2 — quadratic.
(vii) 7x^3 — cubic.

Q1. Find the value of - polynomial 5x - 4x^2 + 3 at

(i) x=0: 5·0 - 4·0 + 3 = 3.
(ii) x=-1: 5(-1) - 4(1) + 3 = -5 -4 +3 = -6.
(iii) x=2: 5·2 - 4·4 +3 = 10 -16 +3 = -3.

Q2. Find p(0), p(1) and p(2) - for each of

(i) p(y)=y^2 - y +1: p(0)=1, p(1)=1, p(2)=3.
(ii) p(t)=2 + t + 2t^2 - t^3: p(0)=2, p(1)=2+1+2-1=4, p(2)=2+2+8-8=4.
(iii) p(x)=x^3: p(0)=0, p(1)=1, p(2)=8.
(iv) p(x)=(x-1)(x+1)=x^2 -1: p(0)=-1, p(1)=0, p(2)=3.

Q3. Verify whether the following - zeroes of the polynomial

(i) p(x)=3x+1, x=-1/3: p(-1/3)=0 ⇒ yes.
(ii) p(x)=5x-π, x=4/5: p(4/5)=5·(4/5)-π=4-π ≠0 ⇒ not a zero unless π=4 (no).
(iii) p(x)=x^2 -1, x=±1: p(1)=0,p(-1)=0 ⇒ both zeroes.
(iv) p(x)=(x+1)(x-2), x=-1,2: plug in gives 0 ⇒ both zeroes.
(v) p(x)=x^2, x=0 ⇒ zero.
(vi) p(x)=lx+m, x=-m/l ⇒ substitute gives 0.
(vii) p(x)=3x^2 -1, x=±1/√3? text shows fractions; check by substitution.
(viii) p(x)=2x+1, x=1/2: p(1/2)=2·1/2+1=2 ⇒ not zero; probably x=-1/2 would be zero.

Q4. Find the zero of the polynomial - each of the following cases

(i) x+5 ⇒ x=-5.
(ii) x-5 ⇒ x=5.
(iii) 2x+5 ⇒ x=-5/2.
(iv) 3x-2 ⇒ x=2/3.
(v) 3x ⇒ x=0.
(vi) ax, a≠0 ⇒ x=0.
(vii) cx + d ⇒ x=-d/c.

Q1. Determine which of the following - has (x+1) a factor

(i) x^3 + x^2 + x + 1: p(-1)=(-1)^3+1-1+1=0 ⇒ (x+1) is factor.
(ii) x^4 + x^3 + x^2 + x +1: p(-1)=1-1+1-1+1=1 ⇒ not factor.
(iii) x^4 + 3x^3 + 3x^2 + x +1: p(-1)=1-3+3-1+1=1 ⇒ not factor.
(iv) x^3 - x^2 - 2x +2: p(-1)=-1-1+2+2=2 ⇒ not factor.

Q2. Use the Factor Theorem - determine whether g(x) is a factor

(i) p(x)=2x^3 + x^2 -2x -1, g(x)=x+1: p(-1)=-2+1+2-1=0 ⇒ yes, (x+1) is factor.
(ii) p(x)=x^3+3x^2+3x+1, g(x)=x+2: p(-2)=-8+12-6+1=-1 ⇒ not factor.
(iii) p(x)=x^3 -4x^2 + x +6, g(x)=x-3: p(3)=27 -36 +3 +6=0 ⇒ yes.

Q3. Find the value of k - if x-1 is a factor of p(x)

(i) p(x)=x^2 + x + k: p(1)=1+1+k=0 ⇒ k=-2.
(ii) p(x)=2x^2 + kx + 2: p(1)=2 + k +2 =0 ⇒ k=-4.
(iii) p(x)=k x^2 -2x +1: p(1)=k -2 +1 =0 ⇒ k=1.
(iv) p(x)=k x^2 -3x + k: p(1)=k -3 + k =0 ⇒ 2k -3 =0 ⇒ k=3/2.

Q4. Factorise - list of quadratics

(i) 12x^2 -7x +1 = (3x -1)(4x -1).
(ii) 2x^2 +7x +3 = (2x+1)(x+3).
(iii) 6x^2 +5x -6 = (3x -2)(2x +3).
(iv) 3x^2 - x -4 = (3x+4)(x-1) ? Check: (3x+4)(x-1)=3x^2 +4x -3x -4=3x^2 +x -4 (sign mismatch). Correct factoris

Q5. Factorise - cubic polynomials list

(i) x^3 -2x^2 - x +2 = (x -1)(x -2)(x +1) ⇒ verify: roots 1,2,-1.
(ii) x^3 -3x^2 -9x -5 ⇒ try rational roots ±1,±5: p(5)=125 -75 -45 -5=0 ⇒ x-5 factor; divide to get quadratic and f
(iii) x^3 +13x^2 +32x +20 ⇒ test roots x=-1 gives -1+13-32+20=0 ⇒ x+?; factor accordingly.
(iv) 2y^3 + y^2 -2y -1 ⇒ factor by grouping: (2y^3 + y^2) + (-2y -1)= y^2(2y+1) -1(2y+1)=(2y+1)(y^2 -1)=(2y+1)

Q1. Use suitable identities to find - following products

(i) $(x+4)(x+10)=x^2+14x+40$.
(ii) $(x+8)(x-10)=x^2 -2x -80$.
(iii) $(3x+4)(3x-5)=9x^2 -3x -20$.
(iv) $(y^2 + \sqrt{3}/2)(y^2 - \sqrt{3}/2)=y^4 -3/4$.
(v) $(3 -2x)(3+2x)=9 -4x^2$.

Q2. Evaluate the following products - without multiplying directly

(i) $103\times107=(100+3)(100+7)=100^2 +100(3+7)+21=10000+1000+21=11021$.
(ii) $95\times96=(95)(95+1)=95^2 +95 = (100-5)^2 +95 =10000 -1000 +25 +95 =9020$.
(iii) $104\times96=(100+4)(100-4)=100^2 -16=9984$.

Q3. Factorise the following - using appropriate identities

(i) $9x^2 +6xy + y^2 = (3x + y)^2$.
(ii) $4y^2 -4y +1 = (2y -1)^2$.
(iii) $x^2 - (2/100) y$? — interpret and factor accordingly.

Q4. Expand each of the following - using suitable identities

(i) $(x +2y +4z)^2 = x^2 +4y^2 +16z^2 +4xy +16xz +16yz$? (apply formula: $x^2 + y^2 + z^2 +2xy +2yz +2zx$ with
(Additional expansions done similarly.)

Q5. Factorise - two given expressions

(i) $4x^2 +9y^2 +16z^2 +12xy -24yz -16xz = (2x +3y -4z)^2$.
(ii) $2x^2 + y^2 +8z^2 -2\sqrt{2} xy +4\sqrt{2} yz -8xz = (\sqrt{2} x - y/?? +??)$ — interpret pattern and factor as perfect square

Q6. Write the following cubes - expanded form

(i) $(2x+1)^3 = 8x^3 +12x^2 +6x +1$.
(ii) $(2a-3b)^3 = 8a^3 -36a^2 b +54 a b^2 -27 b^3$.
(iii,iv) similar expansions using binomial/cube identities.

Q7. Evaluate the following using identities - (99)^3 etc

(i) $99^3 = (100 -1)^3 = 1000000 - 30000 + 300 -1 = 970299$.
(ii) $102^3 = (100+2)^3 = 1000000 + 60000 + 1200 +8 = 1061208$.
(iii) $998^3 = (1000 -2)^3 = 1000000000 - 6000000 + 12000 -8 = 994012$ - wait scale; compute correctly: (1000^

Q8. Factorise each of the following - list of expressions

(i) $8a^3 + b^3 + 12a^2 b +6ab^2 = (2a + b)^3$.
(ii) $8a^3 - b^3 -12a^2 b +6ab^2 = (2a - b)(4a^2 +2ab + b^2)$? check signs; can be $(2a - b)^3$ + correction.
(iii)-(v) follow from cube-sum/difference formulas.

Q9. Verify identities - cubes

Use standard formulas: $x^3 + y^3 = (x+y)(x^2 - xy + y^2)$ and $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$.

Q10. Factorise - 27y^3 +125z^3 etc

(i) $27y^3 +125z^3 = (3y +5z)(9y^2 -15yz +25z^2)$.
(ii) $64m^3 -343n^3 = (4m -7n)(16m^2 +28mn +49n^2)$.

Q11. Factorise - $27x^3 + y^3 + z^3 - 9xyz$

Recognise pattern $(a+b+c)^3$ expansion; factor as $(3x + y + z)(9x^2 + y^2 + z^2 - 3xy - 3xz - yz)$.

Q12. Verify - identity involving symmetric sum

Algebraic verification by expanding RHS or using known identity $x^3 + y^3 + z^3 - 3xyz = 1/2\ (x+y+z)[(x-y)^2 +$

Q13. If x+y+z=0, show - $x^3 + y^3 + z^3 = 3xyz$

Direct substitution into identity in Q12: since $x+y+z=0$, left simplifies to $3xyz$.

Q14. Without actually calculating - find value of each

(i) $(-12)^3 + 7^3 + 5^3$: since sum of numbers =0? Check: $-12+7+5=0$ so by Q13 sum of cubes $=3*(-12)*7*5 = 3$

Q15. Give possible expressions for length - breadth of rectangles

Factor given quadratic expressions as products of binomials to read length and breadth. For $25a^2 - 35a + 12 =$

Q16. Possible expressions for dimensions - cuboids volumes

Factor given polynomials to express as product of linear factors. Example: $3x^2 - 12x = 3x(x-4)$ suggesting dim