CLASS 9 MATHS · 2026-27

Polynomials

Polynomials

33	30	3
QUESTIONS	MINUTES	EXERCISES

This belongs to _____ **Date** _____

WHAT YOU'LL GET GOOD AT

- States the degree and finds the value of a polynomial at a point
- Uses the remainder theorem instead of long division
- Uses the factor theorem to test a factor and to find an unknown coefficient
- Factorises a cubic completely
- Applies the expanded identities for three terms and for cubes

Take your time, and have a go at every one. If you get stuck, look at the orange box — Ollie has already done one for you.

Polynomials

Polynomials · 33 questions · tick each box as you finish

Exercise 1 of 3 · 11 questions Answer each one.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

p(2) = 0 for p(x) = x² - 3x + 2, which means 2 is a zero of the polynomial. Notice what that also tells you: since p(2) = 0, the factor theorem says (x - 2) is a factor. Every 'find p(a)' question is quietly a factor question, and seeing that early makes the rest of the chapter much shorter.

1) What is the degree of p(x) = 5x³ - 2x + 7?

2) If p(x) = x² - 3x + 2, find p(2).

3) If p(x) = x³ + 2x² - x + 1, find p(-1).

4) Is x = 3 a zero of p(x) = x² - 5x + 6?

5) Find the zero of p(x) = 2x + 5.

6) What is the degree of p(x) = 7 - 2x + x²?

7) If p(x) = 2x² + x - 6, find p(-1).

8) If p(x) = x³ - 4x, find p(0) and p(2).

9) Is x = -2 a zero of p(x) = x² + 5x + 6?

10) Find the zero of p(x) = 3x - 7.

11) Write the coefficient of x² in p(x) = 5 - 3x² + x³.

Exercise 2 of 3 · 11 questions Use the remainder or factor theorem. Do not use long division.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

For the remainder on dividing by (2x - 1), set 2x - 1 = 0 rather than reaching for x = 1. That gives x = 1/2, and substituting gives 3/2. Children who have learned the theorem as 'put x = a for (x - a)' get this one wrong every time. The rule is really 'substitute the value that makes the divisor zero', which covers every case including this one.

1) Find the remainder when $x^3 - 3x^2 + 4x - 5$ is divided by (x - 2).

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

3) Is (x - 1) a factor of $x^3 - 2x^2 + x$?

4) Find k if (x - 2) is a factor of $x^3 + kx^2 + 2x - 4$.

5) Find the remainder when $4x^3 - 12x^2 + 14x - 3$ is divided by (2x - 1).

6) Find the remainder when $x^3 + x^2 - 2x + 1$ is divided by (x - 2).

7) Find the remainder when $2x^3 - 3x^2 + 4x - 5$ is divided by (x - 1).

8) Is (x - 1) a factor of $x^3 - 6x^2 + 11x - 6$?

9) Find k if (x + 1) is a factor of $x^3 + 3x^2 + kx + 4$.

10) Find the remainder when $xt - x^2 + 2$ is divided by (x + 1).

11) Show that (x - 3) is a factor of $x^3 - 6x^2 + 11x - 6$.

Exercise 3 of 3 · 11 questions Factorise completely. Find one factor by the factor theorem first.

WRITE THE ANSWER

HERE'S ONE DONE FOR YOU

For $x^3 - 3x^2 - 9x - 5$, try small values first: $p(1) = -16$, $p(-1) = -1 - 3 + 9 - 5 = 0$. So $(x + 1)$ is a factor. Dividing gives $x^2 - 4x - 5$, which factorises to $(x + 1)(x - 5)$, so the full answer is $(x + 1)^2(x - 5)$. Two habits make cubics reliable: try ±1 and ±2 before anything else, since exam cubics almost always have a small integer zero, and check the answer by expanding it back.

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

2) $2y^3 + y^2 - 2y - 1$

3) $x^3 - 3x^2 - 9x - 5$

4) $x^3 - 23x^2 + 142x - 120$

5) Expand $(2x + 3y)^3$.

6) $x^3 - 6x^2 + 11x - 6$

7) $x^3 + 6x^2 + 11x + 6$

8) Expand $(x + 2y)^3$.

9) Expand $(3a - b)^3$.

10) Factorise $8x^3 + 27y^3$.

11) Factorise $x^3 - 64$.

All done? How did that feel?

Colour in a star. Three stars means you could teach it to someone else.

☆ ☆ ☆ Tricky · Getting there · Easy now

Answer key

For grown-ups

Polynomials · keep this page back until your child has finished.

1. Answer each one.

1) 3 - the highest power of x present.
2) p(2) = 4 - 6 + 2 = 0. So 2 is a zero of this polynomial.
3) p(-1) = -1 + 2 + 1 + 1 = 3.
4) Yes. p(3) = 9 - 15 + 6 = 0, and a zero is a value that makes the polynomial zero.
5) x = -5/2, from 2x + 5 = 0.
6) 4. The degree is the highest power of x, whatever order the terms are written in.
7) p(-1) = 2(1) + (-1) - 6 = -5.
8) p(0) = 0 and p(2) = 8 - 8 = 0, so 0 and 2 are both zeroes.
9) Yes. p(-2) = 4 - 10 + 6 = 0, and a zero is a value that makes p(x) = 0.
10) 3x - 7 = 0, so x = 7/3.
11) -3. The coefficient carries its sign.

2. Use the remainder or factor theorem. Do not use long division.

1) p(2) = 8 - 12 + 8 - 5 = -1. The remainder is -1.
2) p(-1) = -1 + 3 - 3 + 1 = 0. The remainder is 0, so (x + 1) is a factor.
3) Yes. p(1) = 1 - 2 + 1 = 0, so by the factor theorem (x - 1) is a factor.
4) p(2) = 8 + 4k + 4 - 4 = 8 + 4k. For (x - 2) to be a factor this must be zero, so k = -2.
5) Set 2x - 1 = 0, giving x = 1/2. Then p(1/2) = 1/2 - 3 + 7 - 3 = 3/2. The remainder is 3/2.
6) p(2) = 8 + 4 - 4 + 1 = 9. The remainder is 9.
7) p(1) = 2 - 3 + 4 - 5 = -2. The remainder is -2.
8) Yes. p(1) = 1 - 6 + 11 - 6 = 0, so by the factor theorem (x - 1) is a factor.
9) p(-1) = -1 + 3 - k + 4 = 0, so 6 - k = 0 and k = 6.
10) p(-1) = 1 - 1 + 2 = 2. The remainder is 2.
11) p(3) = 27 - 54 + 33 - 6 = 0, so by the factor theorem (x - 3) is a factor.

3. Factorise completely. Find one factor by the factor theorem first.

1) $(x - 1)(x - 2)(x + 1)$. Since $p(1) = 0$, divide by $(x - 1)$ to get $x^2 - x - 2$, which factorises further.
2) $(y - 1)(y + 1)(2y + 1)$. Since $p(1) = 0$, divide by $(y - 1)$ to get $2y^2 + 3y + 1$.
3) $(x + 1)^2(x - 5)$. Since $p(-1) = 0$, divide by $(x + 1)$ to get $x^2 - 4x - 5 = (x + 1)(x - 5)$.
4) $(x - 1)(x - 10)(x - 12)$. Since $p(1) = 0$, divide by $(x - 1)$ to get $x^2 - 22x + 120$.
5) $8x^3 + 36x^2y + 54xy^2 + 27y^3$, using $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ with $a = 2x$ and $b = 3y$.
6) $(x - 1)(x - 2)(x - 3)$. $p(1) = 0$ gives the first factor, and dividing leaves $x^2 - 5x + 6$.
7) $(x + 1)(x + 2)(x + 3)$. $p(-1) = 0$ gives the first factor.
8) $x^3 + 6x^2y + 12xy^2 + 8y^3$.
9) $27a^3 - 27a^2b + 9ab^2 - b^3$.
10) $(2x + 3y)(4x^2 - 6xy + 9y^2)$, using $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.
11) $(x - 4)(x^2 + 4x + 16)$, using $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.

WHILE YOUR CHILD WORKS

- The rule is 'substitute the value that makes the divisor zero', not 'put x = a'. That covers divisors like $(2x - 1)$, which catch out children who learned the shortcut.
- For cubics, try ±1 and ±2 first. Exam questions are built to have a small integer zero.
- Always expand the factorised answer back. Fifteen seconds, and it catches every error.