

2.5 Polynomials

2.5.1 Expanding Brackets / 2.5.2 Polynomial Division / 2.5.3 Factor Theorem / 2.5.4 Factorisation

Easy (12 questions)	/52
Medium (8 questions)	/40
Hard (8 questions)	/40
Very Hard (8 questions)	/41
Total Marks	/173

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Easy Questions

1 Expand and simplify

- (i) $(2x + 3)(x - 4)$
- (ii) $2p(p + 3)(p - 2)$
- (iii) $(y - 1)(y - 2)^2$

(5 marks)

2 Use the factor theorem to verify that $(x - 2)$ is a factor of $x^3 - x^2 - 14x + 24$.

(2 marks)

3 Factorise

- (i) $4x^2 - 4x - 15$
- (ii) $3x^3 + 11x^2 - 4x$

(4 marks)

4 Divide $x^3 + 6x^2 + 11x + 6$ by $(x + 2)$.

(4 marks)

5 Given $f(x) = x^3 - 5x^2 - 2x + 24$ has a root at $x = 3$, fully factorise $f(x)$.

(6 marks)

6 Use polynomial division to show that $(x - 2)$ is a factor of $2x^3 + 3x^2 - 18x + 8$.

(4 marks)

7 Given $x = -2$ is a root of the function $f(x) = x^3 - 3x^2 - 8x + 4$, fully factorise $f(x)$.

(4 marks)

- 8 Given that $(x - 4)$ is a factor of $x^3 - kx^2 - 4x + 16$, find the value of k .

(3 marks)

- 9 Given that $x = \frac{1}{2}$ is a root of the function $f(x) = 2x^3 + (p^2 + 1)x^2 - 11x + 4$, find the possible values of p .

(4 marks)

10 (a) Given that $(x + 1)$ is a factor of $f(x) = x^3 - 5x^2 + 3x + 9$, fully factorise $f(x)$.

(4 marks)

(b) Sketch the graph of $y = f(x)$, labelling the coordinates of all points where the graph intersects the coordinate axes.

(3 marks)

11 Find the remainder when $x^3 - 7x - 6$ is divided by $(x + 4)$.

(4 marks)

12 The function $f(x)$ is given by $f(x) = x^4 + ax^3 - 13x^2 - 38x - 4b$, where a and b are constants.

Given that both $(x + 1)$ and $(x + 2)$ are factors of $f(x)$ find the values of a and b .

(5 marks)

Medium Questions

1 (a) Expand and simplify $y(2x + 2)(7 - x)$.

(1 mark)

(b) A rectangle has side lengths of $(3x - 2y + 5)$ units and $(x + 3y - 1)$ units. Find an expression for the area of the rectangle in terms of x and y .

(2 marks)

2 Given that $(3x + y)(2x - 3y)(x - 2y) = ax^3 + bx^2y + cxy^2 + dy^3$, where a , b , c and d are constants, find the values of a , b , c and d .

(2 marks)

3 Factorise completely $3x^3 - 51x^2 + 126x$.

(2 marks)

4 Divide $x^3 - 6x^2 - 9x + 14$ by $(x - 7)$.

(2 marks)

5 (a) $f(x) = 2x^3 - x^2 - 16x + 15$

Find the remainder when $f(x)$ is divided by $(x - 2)$.

(2 marks)

(b) Given that $(x + 3)$ is a factor of $f(x)$, factorise $f(x)$ completely.

(4 marks)

6 (a) $f(x) = 2x^3 - 3x^2 - 72x - 35$

Show that $f(x) = (2x + 1)(ax^2 + bx + c)$ where a , b and c are constants to be found.

(2 marks)

(b) Hence factorise $f(x)$ completely.

(4 marks)

(c) Write down all the real roots of the equation $f(x) = 0$.

(2 marks)

7 (a) $f(x) = 4x^3 + 4x^2 - 23x - 30$

Use the factor theorem to show that $(x + 2)$ is a factor of $f(x)$.

(2 marks)

(b) Factorise $f(x)$ completely.

(4 marks)

(c) Write down all the real roots of the equation $f(x) = 0$.

(2 marks)

8 (a) $f(x) = x^3 + 9x^2 + rx + s$. Given that $f(2) = 0$ and $f(-1) = -54$:

find the values of r and s .

(6 marks)

(b) Factorise $f(x)$ completely.

(3 marks)

Hard Questions

1 (a) Expand and simplify $(2 - x)(3x + 1)(x + 1)$.

(1 mark)

(b) A square has side lengths of $(5x - 2y + 3)$ units. Find an expression for the length of the diagonal of the square in terms of x and y .

(2 marks)

2 Given that $(2x - 3y)^2(y - 2x) = ax^3 + bx^2y + cxy^2 + dy^3$, where a , b , c and d are constants, find the values of a , b , c and d .

(2 marks)

3 Factorise completely $15x^3 + 19x^2 - 10x$.

(2 marks)

4 Divide $x^3 - 19x - 30$ by $(x - 5)$.

(2 marks)

5 (a) $f(x) = x^3 - 28x + 48$

Find the remainder when $f(x)$ is divided by $(x - 3)$.

(2 marks)

(b) Given that $(x + 6)$ is a factor of $f(x)$, factorise $f(x)$ completely.

(4 marks)

6 (a) $f(x) = 6x^3 - 19x^2 + 11x + 6$

Show that $f(x) = (2x - 3)(ax^2 + bx + c)$ where a , b and c are constants to be found.

(2 marks)

(b) Hence factorise $f(x)$ completely.

(4 marks)

(c) Write down all the real roots of the equation $f(x) = 0$.

(2 marks)

7 (a) $f(x) = 4x^3 - 7x - 3$

Use the factor theorem to show that $(2x + 1)$ is a factor of $f(x)$.

(2 marks)

(b) Factorise $f(x)$ completely.

(4 marks)

(c) Write down all the real roots of the equation $f(x) = 0$.

(2 marks)

8 (a) $f(x) = x^3 + rx^2 + sx - 30$. Given that $f(2) = 0$ and $f(-3) = -240$:

find the values of r and s .

(6 marks)

(b) Factorise $f(x)$ completely.

(3 marks)

Very Hard Questions

1 (a) Expand and simplify $(x + y)(x - y)(y - x)(-x - y)$.

(2 marks)

(b) A cuboid has a length of $(2x - 3y + 3)$ units, a width of $(2x + 3y - 3)$ units, and a height of $(x - y)$ units. Find an expression for the volume of the cuboid in terms of x and y .

(2 marks)

2 Given that $(ax + by)(2x + y)(x - 3y) = 8x^3 + cx^2y + dxy^2 - 9y^3$, where a , b , c and d are constants, find the values of a , b , c and d .

(3 marks)

3 Factorise completely $x^5y - xy^5$.

(3 marks)

4 Divide $4x^4 - 37x^2 + 9$ by $(2x - 1)$.

(3 marks)

5 (a) $f(x) = 6x^4 + 7x^3 - 27x^2 - 28x + 12$

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

(2 marks)

(b) Given that $(x + 2)$ is a factor of $f(x)$, factorise $f(x)$ completely.

(5 marks)

6 (a) $f(x) = 3x^4 + x^3 - 12x^2 - 49x - 15$

Show that $f(x) = (3x + 1)(ax^3 + bx^2 + cx + d)$ where a , b , c and d are constants to be found.

(2 marks)

(b) Given that $(x - 3)$ is a factor of $f(x)$, factorise $f(x)$ completely.

(5 marks)

(c) Hence show that the equation $f(x) = 0$ has exactly 2 real roots.

(2 marks)

7 Given that 3 is a root of the equation $2x^3 - x^2 - 11x - 12 = 0$, prove that the equation has no other real roots.

(4 marks)

8 (a) $f(x) = 2x^4 - 15x^3 - 10x^2 + 105x + 98$

Show that $f(-1) = 0$ and $f(-2) = 0$.

(1 mark)

(b) Hence, solve $f(x) = 0$.

(7 marks)