

# Polynomial Division

Teacher guide and model answers

Module 2 | Student Book pages 10-13 | Suggested time: 50 minutes | 20 marks



## Learning goals

- Explain and apply long division with valid conditions and clear reasoning.
- Explain and apply division identity with valid conditions and clear reasoning.
- Explain and apply missing powers with valid conditions and clear reasoning.

## Quick reference

|                          |                                                                                        |
|--------------------------|----------------------------------------------------------------------------------------|
| <b>Long division</b>     | Polynomial long division repeatedly cancels the current leading term.                  |
| <b>Division identity</b> | For dividend A and nonzero divisor B, $A=BQ+R$ with $\deg(R)<\deg(B)$ .                |
| <b>Missing powers</b>    | A zero coefficient preserves the correct place value when a polynomial skips a degree. |

## Worked example

What is the remainder when  $P(x) = x^2 + x + 2$  is divided by  $x - 2$ ? Worked solution: By the Remainder Theorem, substitute  $x=2$ :  $P(2)=8$ .

# Graduated practice

Answer without viewing the key. Show complete working for short-response questions.

1. What is the remainder when  $P(x) = x^2 + x + 2$  is divided by  $x - 2$ ? [1 marks]

- A) -8  
B) 10  
C) 8  
D) 5

**Answer: 8**

By the Remainder Theorem, substitute  $x=2$ :  $P(2)=8$ .

2. What is the remainder when  $P(x) = x^2 + x - 22$  is divided by  $x - 5$ ? [1 marks]

- A) 8  
B) -8  
C) 13  
D) 2

**Answer: 8**

By the Remainder Theorem, substitute  $x=5$ :  $P(5)=8$ .

3. What is the remainder when  $P(x) = x^2 + 3x - 2$  is divided by  $x - 1$ ? [1 marks]

- A) -2  
B) 3  
C) 2  
D) 2 + 1

**Answer: 2**

By the Remainder Theorem, substitute  $x=1$ :  $P(1)=2$ .

4. What is the remainder when  $P(x) = x^2 + x - 7$  is divided by  $x - 3$ ? [1 marks]

- A) 5  
B) -5  
C) 8  
D) 1

**Answer: 5**

By the Remainder Theorem, substitute  $x=3$ :  $P(3)=5$ .

5. What is the remainder when  $P(x) = x^2 + 5x + 1$  is divided by  $x - 1$ ? [1 marks]

- A) -7  
B) 8  
C) 7  
D) 1

**Answer: 7**

By the Remainder Theorem, substitute  $x=1$ :  $P(1)=7$ .

6. What is the remainder when  $P(x) = x^2 + 2x - 23$  is divided by  $x - 4$ ? [1 marks]

A) 1

B) -1

C) 5

D) -5

**Answer: 1**

By the Remainder Theorem, substitute  $x=4$ :  $P(4)=1$ .

7. True or false: Polynomial long division repeatedly cancels the current leading term. [1 marks]

☐ True ☐ False

**Answer: True**

True. Polynomial long division repeatedly cancels the current leading term.

8. True or false: The remainder may have the same degree as the divisor. [1 marks]

☐ True ☐ False

**Answer: False**

False. For dividend  $A$  and nonzero divisor  $B$ ,  $A=BQ+R$  with  $\deg(R)<\deg(B)$ .

9. What is the remainder when  $P(x) = x^2 + x + 4$  is divided by  $x - 1$ ? Show a complete method. [3 marks]

**Answer: 6**

By the Remainder Theorem, substitute  $x=1$ :  $P(1)=6$ .

Rubric: valid method 1 | correct substitution/calculation 1 | clear checked result 1

10. What is the remainder when  $P(x) = x^2 + x - 16$  is divided by  $x - 3$ ? Show a complete method. [3 marks]

**Answer: -4**

By the Remainder Theorem, substitute  $x=3$ :  $P(3)=-4$ .

Rubric: valid method 1 | correct substitution/calculation 1 | clear checked result 1

11. What is the remainder when  $P(x) = x^2 - x - 4$  is divided by  $x - 3$ ? Show a complete method. [3 marks]

**Answer: 2**

By the Remainder Theorem, substitute  $x=3$ :  $P(3)=2$ .

Rubric: valid method 1 | correct substitution/calculation 1 | clear checked result 1

12. What is the remainder when  $P(x) = x^2 + 3x - 1$  is divided by  $x - 1$ ? Show a complete method. [3 marks]

**Answer: 3**

By the Remainder Theorem, substitute  $x=1$ :  $P(1)=3$ .

Rubric: valid method 1 | correct substitution/calculation 1 | clear checked result 1

# Challenge and review

1. Write the polynomial division identity and state the degree condition on the remainder.

For nonzero  $B$ ,  $A=BQ+R$  with  $\deg(R)<\deg(B)$ .

2. Create a polynomial with a missing power and explain how to prepare it for long division.

Accept a valid example; a zero coefficient must hold the missing power's place before alignment and division.

3. Error analysis: a student wrote  $A=Q+BR$ . Explain the error and write the correct identity.

The divisor and remainder have been misplaced; the correct identity is  $A=BQ+R$ .

## Follow-up plan

Below 14/20: revisit the division identity and power ordering, then retry Questions 1-4 and 9. At 14 or above: continue to the online module challenge.