

Rational Expressions

Teacher guide and model answers

Module 3 | Student Book pages 14-20 | Suggested time: 50 minutes | 20 marks



Learning goals

- Explain and apply factor before cancelling with valid conditions and clear reasoning.
- Explain and apply multiplication and division with valid conditions and clear reasoning.
- Explain and apply common denominator with valid conditions and clear reasoning.

Quick reference

Factor before cancelling	Only common factors, not separate terms, may be cancelled.
Multiplication and division	Multiply rational expressions after factoring; divide by multiplying by the reciprocal.
Common denominator	Addition or subtraction requires a common denominator built from all required factors.

Worked example

For $x \neq 6$, evaluate $(x^2 - 36)/(x - 6)$ at $x = 11$. Worked solution: Factor $x^2 - 36 = (x - 6)(x + 6)$; cancel only because $x \neq 6$. The value is $11 + 6 = 17$.

Graduated practice

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

1. For $x \neq 6$, evaluate $(x^2 - 36)/(x - 6)$ at $x = 11$. [1 marks]

- A) 5
B) 85
C) 17
D) 18

Answer: 17

Factor $x^2 - 36 = (x - 6)(x + 6)$; cancel only because $x \neq 6$. The value is $11 + 6 = 17$.

2. For $x \neq 6$, evaluate $(x^2 - 36)/(x - 6)$ at $x = 14$. [1 marks]

- A) 20
B) 8
C) 160
D) 21

Answer: 20

Factor $x^2 - 36 = (x - 6)(x + 6)$; cancel only because $x \neq 6$. The value is $14 + 6 = 20$.

3. For $x \neq 5$, evaluate $(x^2 - 25)/(x - 5)$ at $x = 13$. [1 marks]

- A) 8
B) 144
C) 18
D) 19

Answer: 18

Factor $x^2 - 25 = (x - 5)(x + 5)$; cancel only because $x \neq 5$. The value is $13 + 5 = 18$.

4. For $x \neq 5$, evaluate $(x^2 - 25)/(x - 5)$ at $x = 8$. [1 marks]

- A) 13
B) 3
C) 39
D) 14

Answer: 13

Factor $x^2 - 25 = (x - 5)(x + 5)$; cancel only because $x \neq 5$. The value is $8 + 5 = 13$.

5. For $x \neq 2$, evaluate $(x^2 - 4)/(x - 2)$ at $x = 9$. [1 marks]

- A) 7
B) 77
C) 11
D) 12

Answer: 11

Factor $x^2 - 4 = (x - 2)(x + 2)$; cancel only because $x \neq 2$. The value is $9 + 2 = 11$.

6. For $x \neq 2$, evaluate $(x^2 - 4)/(x - 2)$ at $x = 14$. [1 marks]

A) 16

B) 12

C) 192

D) 17

Answer: 16

Factor $x^2 - 4 = (x - 2)(x + 2)$; cancel only because $x \neq 2$. The value is $14 + 2 = 16$.

7. True or false: Only common factors, not separate terms, may be cancelled. [1 marks]

☐ True ☐ False

Answer: True

True. Only common factors, not separate terms, may be cancelled.

8. True or false: Division is performed by dividing numerators and denominators separately without inversion. [1 marks]

☐ True ☐ False

Answer: False

False. Multiply rational expressions after factoring; divide by multiplying by the reciprocal.

9. For $x \neq 6$, evaluate $(x^2 - 36)/(x - 6)$ at $x = 11$. Show a complete method. [3 marks]

Answer: 17

Factor $x^2 - 36 = (x - 6)(x + 6)$; cancel only because $x \neq 6$. The value is $11 + 6 = 17$.

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

10. For $x \neq 7$, evaluate $(x^2 - 49)/(x - 7)$ at $x = 13$. Show a complete method. [3 marks]

Answer: 20

Factor $x^2 - 49 = (x - 7)(x + 7)$; cancel only because $x \neq 7$. The value is $13 + 7 = 20$.

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

11. For $x \neq 5$, evaluate $(x^2 - 25)/(x - 5)$ at $x = 12$. Show a complete method. [3 marks]

Answer: 17

Factor $x^2 - 25 = (x - 5)(x + 5)$; cancel only because $x \neq 5$. The value is $12 + 5 = 17$.

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

12. For $x \neq 4$, evaluate $(x^2 - 16)/(x - 4)$ at $x = 9$. Show a complete method. [3 marks]

Answer: 13

Factor $x^2 - 16 = (x - 4)(x + 4)$; cancel only because $x \neq 4$. The value is $9 + 4 = 13$.

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

Challenge and review

1. Simplify $(x^2-9)/(x-3)$, then state the excluded value of x and explain why it remains excluded.

For $x \neq 3$, $(x^2-9)/(x-3)=x+3$. The value 3 remains excluded because it makes the original denominator zero.

2. Create a rational expression that simplifies by factoring, then verify it at an allowed value.

Accept a valid factored example with stated restrictions and a numerical check matching the original and simplified forms.

3. Error analysis: a student cancelled x in $(x+4)/x$ and wrote 4. Explain the error and correct the reasoning.

Terms in a sum cannot be cancelled; for $x \neq 0$, $(x+4)/x=1+4/x$, not 4.

Follow-up plan

Below 14/20: revisit factoring and domain restrictions before cancellation, then retry Questions 1-4 and 9. At 14 or above: continue to the online module challenge.