

x	1	2	3	4	5	10
$x + 3$						

14. C Substitution (244830)

Use the algebraic expression $x - 5$ to complete the table. (3 marks)

x	1	2	3	4	5	10
$x - 5$						

15. C Substitution (244862)

Use the algebraic expression $4 - x$ to complete the table. (3 marks)

x	1	2	3	4	5	10
$4 - x$						

16. C Substitution (243207)

Evaluate the expression $\frac{c}{2} - \frac{b}{3} + a$ when $a = -4$, $b = -3$ and $c = 10$. (2 marks)

17. C Substitution (244846)

Use the algebraic expression $2x + 1$ to complete the table. (3 marks)

x	1	2	3	4	5	10
$2x + 1$						

18. C Substitution (244848)

Use the algebraic expression $x^2 + 1$ to complete the table. (3 marks)

x	1	2	3	4	5	10
$x^2 + 1$						

19. C Substitution (243212)

Evaluate the expression w^2 when:

- a. $w = 4$ (1 mark)
- b. $w = -1$ (2 marks)
- c. $w = \frac{1}{3}$ (2 marks)

20. C Substitution (244854)

Use the algebraic expression $x^2 - 3x$ to complete the table. (3 marks)

x	1	2	3	4	5	10
$x^2 - 3x$						

21. C Substitution (243216)

Evaluate the expression $-2x^2$ when:

- a. $x = 1$ (1 mark)
- b. $x = -2$ (2 marks)
- c. $x = \frac{1}{2}$ (2 marks)

22. B Substitution (243225)

Evaluate the expression $x^2 + 3x - 4$ when:

- a. $x = 1$ (2 marks)
- b. $x = 3$ (2 marks)

Worked Solutions

1. **D** Substitution (242486)

$$\begin{aligned} 3 \times x &= 3 \times 4 \\ &= 12 \\ \Rightarrow C \end{aligned}$$

2. **C** Substitution (242489)

$$\begin{aligned} a + b &= 2 + -1 \\ &= 1 \\ \Rightarrow D \end{aligned}$$

3. **C** Substitution (242498)

$$\begin{aligned} 2x + 3y &= 2 \times 5 + 3 \times -2 \\ &= 10 + -6 \\ &= 4 \\ \Rightarrow A \end{aligned}$$

4. **C** Substitution (243188)

$$\begin{aligned} 10 - 2y &= 10 - 2 \times 4 \\ &= 10 - 8 \\ &= 2 \end{aligned}$$

5. **C** Substitution (243191)

$$\begin{aligned} -2 - 5m &= -2 - 5 \times (-1) \\ &= -2 + 5 \\ &= 3 \end{aligned}$$

6. **C** Substitution (243193)

$$\begin{aligned} 3z + 11 &= 3 \times 3 + 11 \\ &= 9 + 11 \\ &= 20 \end{aligned}$$

Worked Solutions

7. **C** Substitution (243195)

$$\begin{aligned} 4m - 5n &= 4 \times 2 - 5 \times 4 \\ &= 8 - 20 \\ &= -12 \end{aligned}$$

8. **C** Substitution (243197)

$$\begin{aligned} -2x + 7y &= -2 \times 1 + 7 \times -2 \\ &= -2 - 14 \\ &= -16 \end{aligned}$$

9. **C** Substitution (243199)

$$\begin{aligned} 11 + a - 3b &= 11 + 13 - 3 \times 8 \\ &= 11 + 13 - 24 \\ &= 0 \end{aligned}$$

10. **C** Substitution (243204)

$$\begin{aligned} \frac{20}{c} + \frac{15}{d} &= \frac{20}{-2} + \frac{15}{3} \\ &= -10 + 5 \\ &= -5 \end{aligned}$$

11. **C** Substitution (244857)

x	1	2	3	4	5	10
$5x$	5	10	15	20	25	50

12. **C** Substitution (244859)

x	1	2	3	4	5	10
$-x$	-1	-2	-3	-4	-5	-10

13. **C** Substitution (244821)

x	1	2	3	4	5	10
$x + 3$	4	5	6	7	8	13

14. **c** Substitution (244830)

x	1	2	3	4	5	10
$x - 5$	-4	-3	-2	-1	0	5

15. **c** Substitution (244862)

x	1	2	3	4	5	10
$4 - x$	3	2	1	0	-1	-6

16. **c** Substitution (243207)

$$\begin{aligned}\frac{c}{2} - \frac{b}{3} + a &= \frac{10}{2} - \left(\frac{-3}{3}\right) + (-4) \\ &= 5 - (-1) - 4 \\ &= 2\end{aligned}$$

17. **c** Substitution (244846)

x	1	2	3	4	5	10
$2x + 1$	3	5	7	9	11	21

18. **c** Substitution (244848)

x	1	2	3	4	5	10
$x^2 + 1$	2	5	10	17	26	101

19. **c** Substitution (243212)

a. $w^2 = 4^2$
 $= 4 \times 4$
 $= 16$

b. $w^2 = (-1)^2$
 $= (-1) \times (-1)$
 $= 1$

c. $w^2 = \left(\frac{1}{3}\right)^2$
 $= \frac{1}{3} \times \frac{1}{3}$
 $= \frac{1}{9}$

20. **c** Substitution (244854)

x	1	2	3	4	5	10
$x^2 - 3x$	-2	-2	0	4	10	70

21. **c** Substitution (243216)

a. $-2x^2 = -2 \times 1^2$
 $= -2 \times 1 \times 1$
 $= -2$

b. $-2x^2 = -2 \times (-2)^2$
 $= -2 \times (-2) \times (-2)$
 $= -8$

c. $-2x^2 = -2 \times \left(-\frac{1}{2}\right)^2$
 $= -2 \times \left(-\frac{1}{2}\right) \times \left(-\frac{1}{2}\right)$
 $= -2 \times \frac{1}{4}$
 $= -\frac{1}{2}$

22. **B** Substitution (243225)

a. $x^2 + 3x - 4 = 1^2 + 3 \times 1 - 4$
 $= 1 \times 1 + 3 - 4$
 $= 0$

b. $x^2 + 3x - 4 = 3^2 + 3 \times 3 - 4$
 $= 3 \times 3 + 3 \times 3 - 4$
 $= 14$

MATHEMATICS

Stage 4

Number and Algebra, Algebraic Techniques

Simplifying Algebraic Expressions

Teacher: Chi Binh Le

Exam Equivalent Time: 178.5 minutes (based on allocation ~1.25 min/mark)

Questions

1. **c** Simplifying Algebraic Expressions (241824)

Which of the following expressions is equivalent to the sum of $3x$ and 4 ?

- A. $12x$
- B. $4 + 3x$
- C. $\frac{3x}{4}$
- D. $3x - 4$

2. **c** Simplifying Algebraic Expressions (243984)

Which of the following algebraic expressions is equivalent to $4 \times x \times y \times 2$?

- A. $42xy$
- B. $8xy$
- C. $4xy^2$
- D. $16xy$

3. **c** Simplifying Algebraic Expressions (241835)

Which of the following expressions is equivalent to the sum of -5 and $2x$?

- A. $2x - 5$
- B. $-10x$
- C. $\frac{2x}{-5}$
- D. $-5 - 2x$

4. **c** Simplifying Algebraic Expressions (243986)

Which of the following algebraic expressions is equivalent to $3a \times 2b \times ab \times 2$?

- A. $7ab$
- B. $12ab$
- C. $6a^2b^2$
- D. $12a^2b^2$

5. **c** Simplifying Algebraic Expressions (241837)

Which of the following expressions is equivalent to the difference between x and 10 ?

- A. $10x$
- B. $-x - 10$
- C. $\frac{x}{10}$
- D. $x - 10$

6. **c** Simplifying Algebraic Expressions (241853)

Which of the following expressions is equivalent to the difference between $3y$ and 4 ?

- A. $-12y$
- B. $3y - 4$
- C. $\frac{3y}{4}$
- D. $3y + 4$

7. **c** Simplifying Algebraic Expressions (241863)

Which of the following expressions is equivalent to the product of $8m$ and -2 ?

- A. $\frac{8m}{-2}$
- B. $8m - 2$
- C. $-16m$
- D. $-8m + 2$

8. **c** Simplifying Algebraic Expressions (243990)

Which of the following algebraic expressions is equivalent to $x \times x \times y \times x \times y$?

- A. $6xy$
- B. x^2y^3
- C. x^3y^2
- D. $3x + 2y$

9. **C** Simplifying Algebraic Expressions (241865)

Which of the following expressions is equivalent to the product of x , y and z ?

- A. $x + y + z$
- B. $(xyz)^3$
- C. xyz
- D. $\frac{xy}{z}$

10. **C** Simplifying Algebraic Expressions (241868)

Which of the following expressions is equivalent to the quotient of $2w$ and 7 ?

- A. $2w \times 7$
- B. $14w$
- C. $2w - 7$
- D. $\frac{2w}{7}$

11. **C** Simplifying Algebraic Expressions (241872)

Which of the following expressions is equivalent to the quotient of $t + 8$ and 3 ?

- A. $\frac{t + 8}{3}$
- B. $t + 11$
- C. $24t$
- D. $3(t + 8)$

12. **C** Simplifying Algebraic Expressions (243996)

Which of the following algebraic expressions is equivalent to $\frac{20xy}{5yz}$?

- A. $5xy^2z$
- B. $4xy^2z$
- C. $\frac{4}{z}$
- D. $\frac{4x}{z}$

13. **C** Simplifying Algebraic Expressions (243319)

Which of the following expressions is equivalent to $16ab$?

- A. $16 + a + b$
- B. $4a + 3b + 7a + 2b$
- C. $5ab - 20ab + ab$
- D. $2ab - 3ab + 4ab + 13ab$

14. **C** Simplifying Algebraic Expressions (243227)

Which of the following is a like term to $8m$?

- A. $3m^2$
- B. $8mn$
- C. $2m$
- D. $4 + m$

15. **C** Simplifying Algebraic Expressions (243317)

Which of the following expressions is equivalent to $15m - 4n$?

- A. $11mn$
- B. $8m - 5n + 7m + n$
- C. $5m - 6n + 10m - 2n$
- D. $9m - 2n - 6m - 2n$

16. **C** Simplifying Algebraic Expressions (243309)

Which of the following expressions is equivalent to $4a - 3b$?

- A. $7ab$
- B. $2a - 3b - 6a$
- C. $b + 5a - 4b - a$
- D. $(2a)^2 - 3b$

17. **B** Simplifying Algebraic Expressions (244007)

Which of the following expressions is equivalent to $a \div (b \times c)$?

- A. $\frac{ac}{b}$
- B. $\frac{a}{bc}$
- C. $\frac{ab}{c}$
- D. $\frac{bc}{a}$

18. **B** Simplifying Algebraic Expressions (244015)

Which of the following expressions is equivalent to $x \div 2 \times y$?

- A. $\frac{2x}{y}$
- B. $\frac{xy}{2}$
- C. $\frac{2y}{x}$
- D. $\frac{x}{2y}$

19. **B** Simplifying Algebraic Expressions (244017)

Which of the following expressions is equivalent to $m \div (3 \times n)$?

- A. $\frac{m}{3n}$
- B. $\frac{3}{mn}$
- C. $\frac{3m}{n}$
- D. $\frac{mn}{3}$

20. **B** Simplifying Algebraic Expressions (244012)

Which of the following expressions is equivalent to $a \div b \times c$?

- A. $\frac{ac}{b}$
- B. $\frac{a}{bc}$
- C. $\frac{ab}{c}$
- D. $\frac{bc}{a}$

21. **B+** Simplifying Algebraic Expressions (244020)

Which of the following expressions is equivalent to $(m \times 4) \div (3 \times n)$?

- A. $\frac{3m}{4n}$
- B. $\frac{3n}{4m}$
- C. $\frac{3mn}{4}$
- D. $\frac{4m}{3n}$

22. **A** Simplifying Algebraic Expressions (242472)

If x is a negative number, which of the following is true?

- A. $x + 2$ is always negative.
- B. $x \times -1$ is always negative.
- C. $2 - x$ is always negative.
- D. $x - 2$ is always negative.

23. **C** Simplifying Algebraic Expressions (242200)

State the coefficient of c in the expression $2ab + 3b^2 - 7bc - 4c + 8$. (1 mark)

24. **C** Simplifying Algebraic Expressions (242267)

Write an expression for the product of $3xy$ and $-y$. (1 mark)

25. **C** Simplifying Algebraic Expressions (242259)

Write an expression for the product of $4x$ and y . (1 mark)

26. **C** Simplifying Algebraic Expressions (242209)

State the coefficient of y in the expression $2y^3 - 4y^2 + 12xy + 5y - 7$. (1 mark)

27. **C** Simplifying Algebraic Expressions (242215)

Write an expression for the sum of -1 and half of m . (1 mark)

28. **C** Simplifying Algebraic Expressions (242212)

Write an expression for the sum of 5 and 3 lots of v . (1 mark)

29. **C** Simplifying Algebraic Expressions (242324)

Write an expression for the quotient of $2x$ and z^2 . (1 mark)

30. **C** Simplifying Algebraic Expressions (242297)

Write an expression for a quarter of the sum of $5x$ and $4y$. (1 mark)

31. **C** Simplifying Algebraic Expressions (242338)

Write an expression for one-third of m added to one-fifth of $2n$. (2 marks)

32. **C** Simplifying Algebraic Expressions (242350)

Describe the expression $3y + 4$ in words. (2 marks)

33. **C** Simplifying Algebraic Expressions (242361)

Describe the expression $\frac{5}{3q}$ in words. (2 marks)

34. **C** Simplifying Algebraic Expressions (242355)

Describe the expression $(x - y) \times 2$ in words. (2 marks)

35. **C** Simplifying Algebraic Expressions (242345)

Write an expression for subtracting half of x^2 from the product of 3 and y . (2 marks)

36. **C** Simplifying Algebraic Expressions (242318)

Write an expression for 2 added to one-third of x . (1 mark)

37. **C** Simplifying Algebraic Expressions (243954)

Simplify the following algebraic expressions, giving your answer in simplest form.

- a. $5 \times 4y$ (1 mark)
- b. $4m \times 3$ (1 mark)
- c. $2a \times 3b \times 4$ (1 mark)
- d. $4c \times 2b \times 5d$ (1 mark)

38. **C** Simplifying Algebraic Expressions (243249)

Simplify the expression $2m - 6m + 4m - 3m$. (1 mark)

39. **C** Simplifying Algebraic Expressions (243973)

Simplify the following algebraic expressions, giving your answer in simplest form.

- a. $4pq \times 6r$ (1 mark)
- b. $3m \times m$ (1 mark)
- c. $7x \times 3x$ (1 mark)
- d. $2ab \times 3bc \times c$ (1 mark)

40. **C** Simplifying Algebraic Expressions (242370)

Rachel works as a waiter and is paid \$27 per hour.

Write an expression for her wages in a week where she works x hours. (1 mark)

41. **C** Simplifying Algebraic Expressions (243976)

Simplify the following algebraic expressions, giving your answer in simplest form.

- a. $-3mn \times 2m$ (1 mark)
- b. $4a^2b \times (-3b)$ (1 mark)
- c. $-8cd \times (-2d)$ (1 mark)
- d. $4a^2b \times 3abc$ (2 marks)

42. **C** Simplifying Algebraic Expressions (244001)

Simplify the following algebraic expressions, giving your answer in simplest form.

- a. $\frac{9mn}{3}$ (1 mark)
- b. $\frac{4y}{12x}$ (1 mark)
- c. $\frac{16a^2}{-4ab}$ (2 marks)
- d. $\frac{-18b^2}{-24b}$ (2 marks)

43. **C** Simplifying Algebraic Expressions (242403)

A square has sides x centimetres in length.

- a. Write an expression for the perimeter of the square. (1 mark)
- b. Write an expression for the area of the square. (2 marks)

44. **B** Simplifying Algebraic Expressions (243235)

Simplify the expression $3x + 2x + 3y + y$ by collecting like terms. (2 marks)

45. **B** Simplifying Algebraic Expressions (243243)

Simplify the expression $2mn + 3m + 5mn - n$ by collecting like terms. (2 marks)

46. **B** Simplifying Algebraic Expressions (243245)

Simplify the expression $5x - 3y - 4x - 2y$ by collecting like terms. (2 marks)

47. **B** Simplifying Algebraic Expressions (243238)

Simplify the expression $4a + 3b - 5a + 6b$ by collecting like terms. (2 marks)

48. **B** Simplifying Algebraic Expressions (242413)

A rectangle has sides of length ***b*** metres and ***c*** metres in length.

- a. Write an expression for the perimeter of the rectangle. (1 mark)
- b. Write an expression for the area of the rectangle. (2 marks)

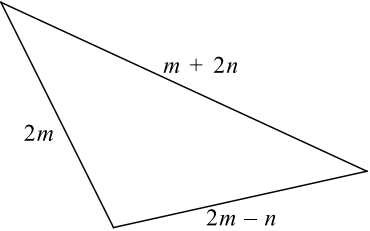
49. **B** Simplifying Algebraic Expressions (242390)

At the local markets mangoes cost ***\$x*** and oranges cost ***\$y***.

Benji bought 6 mangoes and 5 oranges. Write an expression for the total cost of Benji's mangoes and oranges. (2 marks)

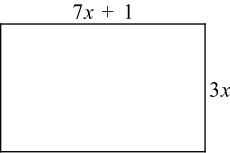
50. **B+** Simplifying Algebraic Expressions (243321)

Write an expression for the perimeter of the triangle below. Give your answer in simplest form. (2 marks)



51. **B+** Simplifying Algebraic Expressions (243324)

Write an expression for the perimeter of the rectangle below. Give your answer in simplest form. (2 marks)



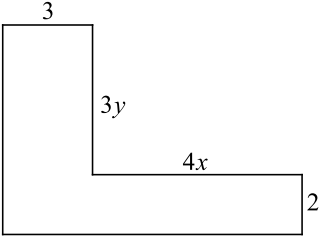
52. **B+** Simplifying Algebraic Expressions (242388)

Juan bought 8 identical Christmas presents online for his relatives.

- a. Write an expression for the total price in dollars, if the cost of each present is ***\$y***. (1 mark)
- b. When he goes to the checkout Juan discovers that all the presents were reduced in price by \$10 each.
 - i. Write an expression for the reduced price of **one** present. (1 mark)
 - ii. Write an expression for the total reduced price of all 8 presents. (2 marks)

53. **B+** Simplifying Algebraic Expressions (243331)

Write an expression for the perimeter of the shape below. Give your answer in simplest form. (2 marks)



54. **A** Simplifying Algebraic Expressions (243694)

State the coefficients of ***x*** and ***y*** that make the expressions below equivalent? (2 marks)

$9x + 3y - \text{ } x + \text{ } y = 6x + 8y$

55. **A** Simplifying Algebraic Expressions (244358)

The perimeter of an equilateral triangle is equal to ***4m + 5***. Write an expression for the side length of the triangle. (2 marks)

56. **A** Simplifying Algebraic Expressions (244362)

The perimeter of a square is equal to ***5q - 3***. Write an expression for the side length of the square. (2 marks)

57. **A** Simplifying Algebraic Expressions (244423)

Simplify the following algebraic expression, giving your answer in simplest form. (2 marks)

$$\frac{5x^2y \times 3xy^2}{10 \times xy}$$

58. **A** Simplifying Algebraic Expressions (244365)

The perimeter of a regular hexagon is equal to ***4x + 3y***. Write an expression for the side length of the hexagon. (2 marks)

59. **A** Simplifying Algebraic Expressions (244420)

Simplify the following algebraic expression, giving your answer in simplest form. (2 marks)

$$\frac{3 \times ab \times 4a}{a \times 2b}$$

60. **A** Simplifying Algebraic Expressions (244367)

The side length of an equilateral triangle is $x + 2$. Write an expression for the perimeter of the triangle. (2 marks)

61. **A** Simplifying Algebraic Expressions (244376)

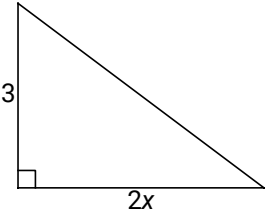
The side length of a square is $x - 3$. Write an expression for the perimeter of the square. (2 marks)

62. **A** Simplifying Algebraic Expressions (244378)

The side length of a regular hexagon is $2x + 5$. Write an expression for the perimeter of the hexagon. (2 marks)

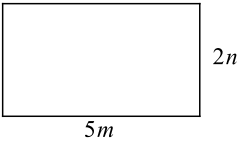
63. **A+** Simplifying Algebraic Expressions (244380)

Write a simplified expression for the area of the triangle below. (2 marks)



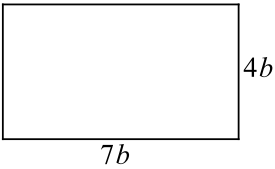
64. **A+** Simplifying Algebraic Expressions (244384)

Write a simplified expression for the area of the rectangle below. (2 marks)



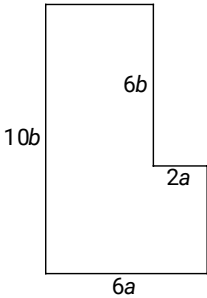
65. **A+** Simplifying Algebraic Expressions (244388)

Write a simplified expression for the area of the rectangle below. (2 marks)



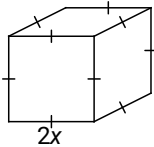
66. **A+** Simplifying Algebraic Expressions (244391)

Write a simplified expression for the area of the shape below. (3 marks)



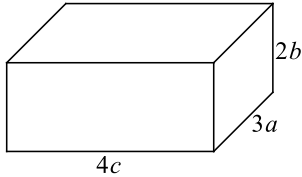
67. **A+** Simplifying Algebraic Expressions (244397)

Write a simplified expression for the volume of the cube below. (3 marks)



68. **A+** Simplifying Algebraic Expressions (244402)

Write a simplified expression for the volume of the rectangular prism below. (3 marks)



69. **A+** Simplifying Algebraic Expressions (244405)

A rectangular prism is known to have a length of **5** cm, a width of **3** cm and a height of $x + 2$ cm. Write an expression for the volume of the prism, giving your answer in simplest form. (3 marks)

Worked Solutions

1. **C** Simplifying Algebraic Expressions (241824)

Sum means to add

$\therefore 4 + 3x$ is equivalent to the sum of $3x$ and 4
 $\Rightarrow B$

2. **C** Simplifying Algebraic Expressions (243984)

$$\begin{aligned}4 \times x \times y \times 2 \\&= 4 \times 2 \times x \times y \\&= 8xy \\&\Rightarrow B\end{aligned}$$

3. **C** Simplifying Algebraic Expressions (241835)

Sum means to add

$\therefore 2x - 5$ is equivalent to the sum of -5 and $2x$
 $\Rightarrow A$

4. **C** Simplifying Algebraic Expressions (243986)

$$\begin{aligned}3a \times 2b \times ab \times 2 \\&= 3 \times 2 \times 2 \times a \times a \times b \times b \\&= 12a^2b^2 \\&\Rightarrow D\end{aligned}$$

5. **C** Simplifying Algebraic Expressions (241837)

Difference means to subtract

$\therefore x - 10$ is equivalent to the difference between x and 10
 $\Rightarrow D$

6. **C** Simplifying Algebraic Expressions (241853)

Difference means to subtract

$\therefore 3y - 4$ is equivalent to the difference between $3y$ and 4
 $\Rightarrow B$

7. **C** Simplifying Algebraic Expressions (241863)

Product means to multiply

$\therefore -16m$ is equivalent to the product of $8m$ and -2
 $\Rightarrow C$

Worked Solutions

8. **C** Simplifying Algebraic Expressions (243990)

$$\begin{aligned}x \times x \times y \times x \times y \\&= x \times x \times x \times y \times y \\&= x^3y^2 \\&\Rightarrow C\end{aligned}$$

9. **C** Simplifying Algebraic Expressions (241865)

Product means to multiply

$\therefore xyz$ is equivalent to the product of x , y and z
 $\Rightarrow C$

10. **C** Simplifying Algebraic Expressions (241868)

Quotient means to divide

$\therefore \frac{2w}{7}$ is equivalent to the quotient of $2w$ and 7
 $\Rightarrow D$

11. **C** Simplifying Algebraic Expressions (241872)

Quotient means to divide

$\therefore \frac{t+8}{3}$ is equivalent to the quotient of $t+8$ and 3
 $\Rightarrow A$

12. **C** Simplifying Algebraic Expressions (243996)

$$\begin{aligned}\frac{20xy}{5yz} \\&= \frac{5 \times 4 \times x \times y}{5 \times y \times z} \\&= \frac{4x}{z} \\&\Rightarrow D\end{aligned}$$

13. **C** Simplifying Algebraic Expressions (243319)

Option D:

$$\begin{aligned}2ab - 3ab + 4ab + 13ab &= 16ab \\&\Rightarrow D\end{aligned}$$

14. **C** Simplifying Algebraic Expressions (243227)

For like terms algebraic parts are identical:

Option A: $\rightarrow m^2 \neq m$

Option B: $\rightarrow mn \neq m$

Option C: $\rightarrow m = m \checkmark$

Option D: $\rightarrow 4 + m \neq m$

$\therefore 8m$ and $2m$ are like terms.

$\Rightarrow C$

15. **C** Simplifying Algebraic Expressions (243317)

Option B:

$$8m - 5n + 7m + n = 8m + 7m - 5n + n$$

$$= 15m - 4n$$

$\Rightarrow B$

16. **C** Simplifying Algebraic Expressions (243309)

Option C:

$$b + 5a - 4b - a = 5a - a + b - 4b$$

$$= 4a - 3b$$

$\Rightarrow C$

17. **B** Simplifying Algebraic Expressions (244007)

$$a \div (b \times c)$$

$$= \frac{a}{b \times c}$$

$$= \frac{a}{bc}$$

$\Rightarrow B$

18. **B** Simplifying Algebraic Expressions (244015)

$$x \div 2 \times y$$

$$= \frac{x}{2} \times y$$

$$= \frac{xy}{2}$$

$\Rightarrow B$

19. **B** Simplifying Algebraic Expressions (244017)

$$m \div (3 \times n)$$

$$= \frac{m}{3 \times n}$$

$$= \frac{m}{3n}$$

$\Rightarrow A$

20. **B** Simplifying Algebraic Expressions (244012)

$$a \div b \times c$$

$$= \frac{a}{b} \times c$$

$$= \frac{ac}{b}$$

$\Rightarrow A$

21. **B+** Simplifying Algebraic Expressions (244020)

$$(m \times 4) \div (3 \times n)$$

$$= \frac{m \times 4}{3 \times n}$$

$$= \frac{4m}{3n}$$

$\Rightarrow D$

22. **A** Simplifying Algebraic Expressions (242472)

Considering the options

Option 1: If $x \geq -2$ then $x + 2 \geq 0$, $\therefore$ not always negative

Option 2: x is negative $\therefore x \times -1$ is always positive

Option 3: x is negative $\therefore 2 - x$ is always positive

Option 4: x is negative $\therefore x - 2$ is always negative

$\Rightarrow D$

23. **C** Simplifying Algebraic Expressions (242200)

A coefficient is the number in front of a pronumeral

$\therefore -4$ is the coefficient of c

24. **C** Simplifying Algebraic Expressions (242267)

Product means multiply

$\therefore$ product of $3xy$ and $-y \rightarrow -3xy^2$

25. **C** Simplifying Algebraic Expressions (242259)

Product means multiply

$\therefore$ product of $4x$ and $y \rightarrow 4xy$

26. **C** Simplifying Algebraic Expressions (242209)

A coefficient is the number in front of a pronumeral

$\therefore$ 5 is the coefficient of y

27. **C** Simplifying Algebraic Expressions (242215)

Sum means add

$\therefore$ sum of -1 and half of $m \rightarrow -1 + \frac{m}{2}$ or $\frac{m}{2} - 1$

28. **C** Simplifying Algebraic Expressions (242212)

Sum means add

$\therefore$ the sum of 5 and 3 lots of $v \rightarrow 5 + 3v$

29. **C** Simplifying Algebraic Expressions (242324)

Quotient means divide

$\therefore$ quotient of $2x$ and $z^2 = \frac{2x}{z^2}$ or $2x \div z^2$

30. **C** Simplifying Algebraic Expressions (242297)

Sum of $5x$ and $4y = 5x + 4y$

$\therefore$ a quarter of the sum $= \frac{5x + 4y}{4}$

31. **C** Simplifying Algebraic Expressions (242338)

One-third of $m = \frac{m}{3}$ and one-fifth of $2n = \frac{2n}{5}$

$\therefore$ Added together $= \frac{m}{3} + \frac{2n}{5}$

32. **C** Simplifying Algebraic Expressions (242350)

The sum of 4 and product of 3 and y

33. **C** Simplifying Algebraic Expressions (242361)

The quotient of 5 and $3q$

34. **C** Simplifying Algebraic Expressions (242355)

Twice the difference between x and y

35. **C** Simplifying Algebraic Expressions (242345)

Half of $x^2 = \frac{x^2}{2}$ and product 3 and $y = 3y$

$\therefore$ Subtraction $= 3y - \frac{x^2}{2}$

36. **C** Simplifying Algebraic Expressions (242318)

One-third of $x = \frac{x}{3}$ or $\frac{1}{3}x$

$\therefore$ 2 added $= 2 + \frac{x}{3}$ or $2 + \frac{1}{3}x$

37. **C** Simplifying Algebraic Expressions (243954)

a. $5 \times 4y = 5 \times 4 \times y$
 $= 20y$

b. $4m \times 3 = 4 \times 3 \times m$
 $= 12m$

c. $2a \times 3b \times 4 = 2 \times 3 \times 4 \times a \times b$
 $= 24ab$

d. $4c \times 2b \times 5d = 4 \times 2 \times 5 \times c \times b \times d$
 $= 40bcd$

38. **C** Simplifying Algebraic Expressions (243249)

$2m - 6m + 4m - 3m = -3m$

39. **C** Simplifying Algebraic Expressions (243973)

a. $4pq \times 6r = 4 \times 6 \times p \times q \times r$
 $= 24pqr$

b. $3m \times m = 3 \times m \times m$
 $= 3m^2$

c. $7x \times 3x = 7 \times 3 \times x \times x$
 $= 21x^2$

d. $2ab \times 3bc \times c = 2 \times 3 \times a \times b \times b \times c \times c$
 $= 6ab^2c^2$

40. **C** Simplifying Algebraic Expressions (242370)

$\text{Wages} = 27 \times x = \$27x$

41. **C** Simplifying Algebraic Expressions (243976)

a. $-3mn \times 2m = -3 \times 2 \times m \times n \times m$
 $= -6m^2n$

b. $4a^2b \times (-3b) = 4 \times -3 \times a \times a \times b \times b$
 $= -12a^2b^2$

c. $-8cd \times (-2d) = -8 \times -2 \times c \times d \times d$
 $= 16cd^2$

d. $4a^2b \times 3abc = 4 \times 3 \times a \times a \times b \times a \times b \times c$
 $= 12a^3b^2c$

42. **C** Simplifying Algebraic Expressions (244001)

a. $\frac{9mn}{3} = \frac{3 \times 3 \times m \times n}{3}$
 $= 3mn$

b. $\frac{4y}{12x} = \frac{4 \times y}{4 \times 3 \times x}$
 $= \frac{y}{3x}$

c. $\frac{16a^2}{-4ab} = \frac{4 \times 4 \times a \times a}{-4 \times a \times b}$
 $= \frac{-4a}{b}$

d. $\frac{-18b^2}{-24b} = \frac{-6 \times 3 \times b \times b}{-6 \times 4 \times b}$
 $= \frac{3b}{4}$

43. **C** Simplifying Algebraic Expressions (242403)

a. Perimeter
 $= 4 \times x$
 $= 4x \text{ cms}$

b. Area
 $= \text{side}^2$
 $= x^2 \text{ cms}^2$

44. **B** Simplifying Algebraic Expressions (243235)

$3x + 2x + 3y + y = 5x + 4y$

45. **B** Simplifying Algebraic Expressions (243243)

$2mn + 3m + 5mn - n = 2mn + 5mn + 3m - n$
 $= 7mn + 3m - n$

46. **B** Simplifying Algebraic Expressions (243245)

$5x - 3y - 4x - 2y = 5x - 4x - 3y - 2y$
 $= x - 5y$

47. **B** Simplifying Algebraic Expressions (243238)

$$4a + 3b - 5a + 6b = 4a - 5a + 3b + 6b$$

$$= -a + 9b \text{ or } 9b - a$$

48. **B** Simplifying Algebraic Expressions (242413)

a. Perimeter

$$= b + c + b + c$$

$$= (2b + 2c) \text{ m}$$

b. Area

$$= \text{length} \times \text{width}$$

$$= b \times c$$

$$= bc \text{ m}^2$$

49. **B** Simplifying Algebraic Expressions (242390)

Total cost

$$= 6 \times x + 5 \times y$$

$$= 6x + 5y$$

50. **B+** Simplifying Algebraic Expressions (243321)

Perimeter

$$= 2m + m + 2n + 2m - n$$

$$= 2m + m + 2m + 2n - n$$

$$= 5m + n$$

51. **B+** Simplifying Algebraic Expressions (243324)

Method 1

Perimeter

$$= 7x + 1 + 3x + 7x + 1 + 3x$$

$$= 7x + 3x + 7x + 3x + 1 + 1$$

$$= 20x + 2$$

Method 2 (Advanced)

Perimeter

$$= 2(7x + 1) + 2 \times 3x$$

$$= 14x + 2 + 6x$$

$$= 20x + 2$$

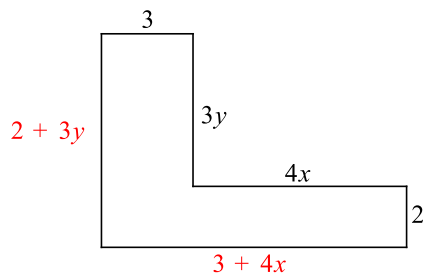
52. **B+** Simplifying Algebraic Expressions (242388)

a. Price = $8 \times y = 8y$

b. i. Reduced Price per present = $y - 10$

ii. Total Reduced Price = $8 \times (y - 10) = 8(y - 10)$

53. **B+** Simplifying Algebraic Expressions (243331)



Perimeter

$$= 3 + 3y + 4x + 2 + 3 + 4x + 2 + 3y$$

$$= 4x + 4x + 3y + 3y + 3 + 2 + 3 + 2$$

$$= 8x + 6y + 10$$

54. **A** Simplifying Algebraic Expressions (243694)

$$9x + 3y - \text{ } x + \text{ } y = 6x + 8y$$

Equating the x values $\rightarrow 9x - \text{ } x = 6x$

$$\therefore \text{ } = 3$$

Equating the y values $\rightarrow 3y + \text{ } y = 8y$

$$\therefore \text{ } = 5$$

55. **A** Simplifying Algebraic Expressions (244358)

An equilateral triangle has all sides equal

$$\therefore \text{Side length} = \frac{\text{Perimeter}}{3}$$

$$= \frac{4m + 5}{3}$$

56. **A** Simplifying Algebraic Expressions (244362)

A square has all sides equal

$$\begin{aligned}\therefore \text{Side length} &= \frac{\text{Perimeter}}{4} \\ &= \frac{5q - 3}{4}\end{aligned}$$

57. **A** Simplifying Algebraic Expressions (244423)

$$\begin{aligned}\frac{5x^2y \times 3xy^2}{10 \times xy} &= \frac{15x^3y^3}{10xy} \\ &= \frac{3x^2y^2}{2}\end{aligned}$$

58. **A** Simplifying Algebraic Expressions (244365)

A regular hexagon has all sides equal

$$\begin{aligned}\therefore \text{Side length} &= \frac{\text{Perimeter}}{6} \\ &= \frac{4x + 3y}{6}\end{aligned}$$

59. **A** Simplifying Algebraic Expressions (244420)

$$\begin{aligned}\frac{3 \times ab \times 4a}{a \times 2b} &= \frac{12a^2b}{2ab} \\ &= 6a\end{aligned}$$

60. **A** Simplifying Algebraic Expressions (244367)

An equilateral triangle has all sides equal

$$\begin{aligned}\therefore \text{Perimeter} &= 3 \times \text{side length} \\ &= 3 \times (x + 2) \\ &= 3 \times x + 3 \times 2 \\ &= 3x + 6\end{aligned}$$

61. **A** Simplifying Algebraic Expressions (244376)

A square has all sides equal

$$\begin{aligned}\therefore \text{Perimeter} &= 4 \times \text{side length} \\ &= 4 \times (x - 3) \\ &= 4 \times x - 4 \times 3 \\ &= 4x - 12\end{aligned}$$

62. **A** Simplifying Algebraic Expressions (244378)

A regular hexagon has all sides equal

$$\begin{aligned}\therefore \text{Perimeter} &= 6 \times \text{side length} \\ &= 6 \times (2x + 5) \\ &= 6 \times 2x + 6 \times 5 \\ &= 12x + 30\end{aligned}$$

63. **A+** Simplifying Algebraic Expressions (244380)

$$\begin{aligned}\text{Area} &= \frac{1}{2} \times \text{base} \times \text{height} \\ &= \frac{1}{2} \times 2x \times 3 \\ &= \frac{1}{2} \times 6x \\ &= 3x\end{aligned}$$

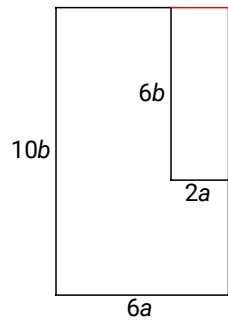
64. **A+** Simplifying Algebraic Expressions (244384)

$$\begin{aligned}\text{Area} &= \text{length} \times \text{width} \\ &= 5m \times 2n \\ &= 10mn\end{aligned}$$

65. **A+** Simplifying Algebraic Expressions (244388)

$$\begin{aligned}\text{Area} &= \text{length} \times \text{width} \\ &= 7b \times 4b \\ &= 28b^2\end{aligned}$$

66. **A+** Simplifying Algebraic Expressions (244391)



Area = Area big rectangle – Area small rectangle

$$= 6a \times 10b - 2a \times 6b$$

$$= 60ab - 12ab$$

$$= 48ab$$

67. **A+** Simplifying Algebraic Expressions (244397)

$$\text{Volume} = (\text{side})^3$$

$$= (2x)^3$$

$$= 2x \times 2x \times 2x$$

$$= 8x^3$$

68. **A+** Simplifying Algebraic Expressions (244402)

Volume = length $\times$ width $\times$ height

$$= 4c \times 3a \times 2b$$

$$= 24abc$$

69. **A+** Simplifying Algebraic Expressions (244405)

Volume = length $\times$ width $\times$ height

$$= 5 \times 3 \times (x + 2)$$

$$= 15\text{times}(x + 2)$$

$$= 15 \times x + 15 \times 2$$

$$= (15x + 30) \text{ cm}^3$$

MATHEMATICS

Stage 4

Number and Algebra, Algebraic Techniques

Expand and Factorise

Teacher: Chi Binh Le

Exam Equivalent Time: 115.5 minutes (based on allocation ~1.25 min/mark)

Questions

1. **E** Expand and Factorise (245499)

Which of the following is the correct factorisation of $3x - 12$.

- A. $3(x - 12)$
- B. $x(3 - 12x)$
- C. $3(x - 9)$
- D. $3(x - 4)$

2. **C** Expand and Factorise (245517)

Which of the following is the correct factorisation of $15m - 20$.

- A. $15(m - 20)$
- B. $5(m - 4)$
- C. $5(3m - 4)$
- D. $5(3m - 20)$

3. **C** Expand and Factorise (245519)

Which of the following is the correct factorisation of $7y + 14x$.

- A. $7(y + 2x)$
- B. $y(7 + 14x)$
- C. $7(y + 14x)$
- D. $7(y + 7x)$

4. **C** Expand and Factorise (245036)

The expansion of $4x(5 - y)$ is:

- A. $9x - 4xy$
- B. $4x - 5xy$
- C. $20 - 4xy$
- D. $20x - 4xy$

5. **C** Expand and Factorise (245039)

The expansion of $-2q(q - 8)$ is:

- A. $-2q + 16$
- B. $-2q^2 + 16q$
- C. $-2q^2 - 16q$
- D. $2q^2 + 16q$

6. **C** Expand and Factorise (244865)

Use the distributive law to expand the expression $3(x + 1)$. (2 marks)

7. **C** Expand and Factorise (244869)

Use the distributive law to expand the expression $4(m - 3)$. (2 marks)

8. **C** Expand and Factorise (244873)

Use the distributive law to expand the expression $-10(y + 4)$. (2 marks)

9. **C** Expand and Factorise (244875)

Use the distributive law to expand the expression $-(a - 8)$. (2 marks)

10. **C** Expand and Factorise (244877)

Use the distributive law to expand the expression $x(x + 2)$. (2 marks)

11. **C** Expand and Factorise (244879)

Use the distributive law to expand the expression $b(3 - b)$. (2 marks)

12. **C** Expand and Factorise (244881)

Use the distributive law to expand the expression $9x(x - 2y)$. (2 marks)

13.

c

Expand and Factorise (244883)

Expand and simplify the expression $2(m + 2) + 7m$. (2 marks)

14.

c

Expand and Factorise (244886)

Expand and simplify the expression $3xy - 2x(y - 5)$. (2 marks)

15.

c

Expand and Factorise (244890)

Expand and simplify the expression $3(x - 1) + 4(2x + 3)$. (2 marks)

16.

c

Expand and Factorise (245445)

List all the factors of $2x$. (2 marks)

17.

c

Expand and Factorise (245477)

List all the factors of $-6z$. (2 marks)

18.

c

Expand and Factorise (245488)

State the highest common factor of $27ab^2c$ and $3a^2b^2c$. (1 mark)

19.

c

Expand and Factorise (245494)

State the highest common factor of $36mn^2$ and $24m^2n$. (1 mark)

20.

c

Expand and Factorise (245481)

State the highest common factor of $15xy$ and $20y$. (1 mark)

21.

c

Expand and Factorise (245473)

List all the factors of $-7q$. (2 marks)

22.

c

Expand and Factorise (244894)

Expand and simplify the expression $2(5 - 4x) + 3(6x - 1)$. (2 marks)

23.

c

Expand and Factorise (244897)

A number x is added to 4 and the result is doubled.
Write an algebraic expression and expand it to represent this information. (2 marks)

24.

c

Expand and Factorise (244900)

A number b is tripled and 5 is subtracted. The result is then doubled.
Write an algebraic expression and expand it to represent this information. (2 marks)

25.

c

Expand and Factorise (244902)

A number x is doubled and 1 is added. The result is then multiplied by 5 .
Write an algebraic expression and expand it to represent this information. (2 marks)

26.

c

Expand and Factorise (245521)

Fully factorise the following:
a. $4x^2 - 2x$ (2 marks)
b. $-6ab + 3a$ (2 marks)
c. $-5q - 10q^2$ (2 marks)

27.

c

Expand and Factorise (245463)

List all the factors of $-12y$. (2 marks)

28.

c

Expand and Factorise (246232)

Fully factorise $2mn^2 + 6m^2n - 8mn$. (2 marks)

29.

c

Expand and Factorise (246235)

Fully factorise $24p^2qr^3 + 18p^3q^2 + 6p^2qr^2$. (2 marks)

30.

c

Expand and Factorise (245423)

List all the factors of $4b$. (2 marks)

31.

c

Expand and Factorise (246075)

A rectangle has an area of $9a^2 - 6a$. By factorising the expression, find the width of the rectangle if the length is $3a$. (2 marks)

32.

c

Expand and Factorise (245448)

List all the factors of $10m$. (2 marks)

33.

c

Expand and Factorise (246227)

A rectangle has an area of $9a^2 - 6a$. By factorising the expression, find the width of the rectangle if the length is $3a$. (2 marks)

34. **C** Expand and Factorise (244905)

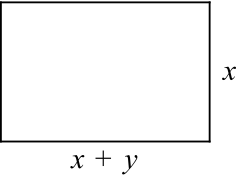
A number y is halved and 3 is added. The result is then multiplied by 4.
Write an algebraic expression and expand it to represent this information. (2 marks)

35. **C** Expand and Factorise (246230)

A rectangle has an area of $2pq^2 + 4p^2q$. By factorising the expression, find the length of the rectangle if the width is $2pq$. (2 marks)

36. **B** Expand and Factorise (244918)

A rectangle below has a length of $(x + y)$ and a width of x .



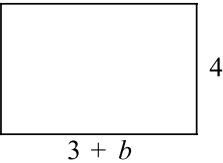
Write an algebraic expression and expand it to represent the area of the rectangle. (2 marks)

37. **B** Expand and Factorise (244924)

Jimmy works x hours every week and his hourly rate of pay is $(40 + y)$.
Write an algebraic expression and expand it to represent Jimmy's weekly wage. (2 marks)

38. **B** Expand and Factorise (244910)

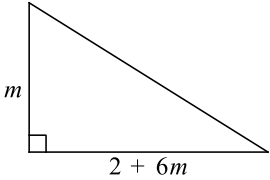
A rectangle below has a length of $(3 + b)$ and a width of 4.



Write an algebraic expression and expand it to represent the area of the rectangle. (2 marks)

39. **B** Expand and Factorise (245041)

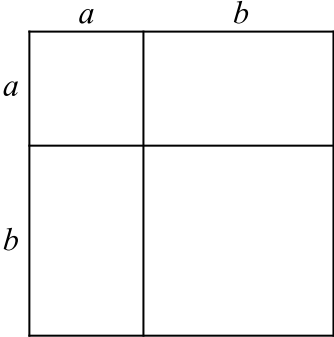
A triangle below has a base of $(2 + 6m)$ and a perpendicular height of m .



Write an algebraic expression and expand it to represent the area of the triangle. (2 marks)

40. **A** Expand and Factorise (245065)

Use the rectangle below to prove that $(a + b)^2 = a^2 + 2ab + b^2$. (3 marks)



Worked Solutions

1. **E** Expand and Factorise (245499)

$$\begin{aligned}3x - 12 &= 3 \times x - 3 \times 4 \quad (\text{HCF} = 3) \\ &= 3(x - 4)\end{aligned}$$

$\Rightarrow D$

2. **C** Expand and Factorise (245517)

$$\begin{aligned}15m - 20 &= 5 \times 3m - 5 \times 4 \quad (\text{HCF} = 5) \\ &= 5(3m - 4)\end{aligned}$$

$\Rightarrow C$

3. **C** Expand and Factorise (245519)

$$\begin{aligned}7y + 14x &= 7 \times y + 7 \times 2x \quad (\text{HCF} = 7) \\ &= 7(y + 2x)\end{aligned}$$

$\Rightarrow A$

4. **C** Expand and Factorise (245036)

$$\begin{aligned}4x(5 - y) &= 4x \times 5 + 4x \times (-y) \\ &= 20x - 4xy\end{aligned}$$

$\Rightarrow D$

5. **C** Expand and Factorise (245039)

$$\begin{aligned}-2q(q - 8) &= -2q \times q - 2q \times (-8) \\ &= -2q^2 + 16q\end{aligned}$$

$\Rightarrow B$

6. **C** Expand and Factorise (244865)

$$\begin{aligned}3(x + 1) &= 3 \times x + 3 \times 1 \\ &= 3x + 3\end{aligned}$$

Worked Solutions

7. **C** Expand and Factorise (244869)

$$\begin{aligned}4(m - 3) &= 4 \times m - 4 \times 3 \\ &= 4m - 12\end{aligned}$$

8. **C** Expand and Factorise (244873)

$$\begin{aligned}-10(y + 4) &= -10 \times y + (-10) \times 4 \\ &= -10y - 40\end{aligned}$$

9. **C** Expand and Factorise (244875)

$$\begin{aligned}-(a - 8) &= -1 \times a - (-1) \times 8 \\ &= -a + 8\end{aligned}$$

10. **C** Expand and Factorise (244877)

$$\begin{aligned}x(x + 2) &= x \times x + x \times 2 \\ &= x^2 + 2x\end{aligned}$$

11. **C** Expand and Factorise (244879)

$$\begin{aligned}b(3 - b) &= b \times 3 - b \times b \\ &= 3b - b^2\end{aligned}$$

12. **C** Expand and Factorise (244881)

$$\begin{aligned}9x(x - 2y) &= 9x \times x - 9x \times 2y \\ &= 9x^2 - 18xy\end{aligned}$$

13. **C** Expand and Factorise (244883)

$$\begin{aligned}2(m + 2) + 7m &= 2 \times m + 2 \times 2 + 7m \\ &= 2m + 4 + 7m \\ &= 9m + 4\end{aligned}$$

14. **C** Expand and Factorise (244886)

$$\begin{aligned}3xy - 2x(y - 5) &= 3xy - 2x \times y - 2x \times (-5) \\ &= 3xy - 2xy + 10x \\ &= xy + 10x\end{aligned}$$

15. **C** Expand and Factorise (244890)

$$\begin{aligned}3(x-1) + 4(2x+3) &= 3 \times x - 3 \times 1 + 4 \times 2x + 4 \times 3 \\&= 3x - 3 + 8x + 12 \\&= 11x + 9\end{aligned}$$

16. **C** Expand and Factorise (245445)

Listing factors in pairs $\rightarrow (1, 2x) (2, x) (-1, -2x) (-2, -x)$

$\therefore$ Factors are: $1, 2, x, 2x, -1, -2, -x, -2x$

17. **C** Expand and Factorise (245477)

Listing factors in pairs $\rightarrow (1, -6z)(2, -3z)(3, -2z)(6, -z)(-1, 6z)(-2, 3z)(-3, 2z)(-6, z)$

$\therefore$ Factors are:

$1, 2, 3, 6, -z, -2z, -3z, -6z$

$-1, -2, -3, -6, z, 2z, 3z, 6z$

18. **C** Expand and Factorise (245488)

HCF of 27 and 3 = 3

HCF of ab^2c and $a^2b^2c = ab^2c$

$\therefore$ HCF of $27ab^2c$ and $3a^2b^2c = 3ab^2c$

19. **C** Expand and Factorise (245494)

HCF of 36 and 24 = 12

HCF of mn^2 and $m^2n = mn$

$\therefore$ HCF of $36mn^2$ and $24m^2n = 12mn$

20. **C** Expand and Factorise (245481)

HCF of 15 and 20 = 5

HCF of xy and $y = y$

$\therefore$ HCF of $15xy$ and $20y = 5y$

21. **C** Expand and Factorise (245473)

Listing factors in pairs $\rightarrow (1, -7q)(7, -q)(-1, 7q)(-7, q)$

$\therefore$ Factors are:

$1, 7, -q, -7q, -1, -7, q, 7q$

22. **C** Expand and Factorise (244894)

$$\begin{aligned}2(5-4x) + 3(6x-1) &= 2 \times 5 + 2 \times (-4x) + 3 \times 6x + 3 \times (-1) \\&= 10 - 8x + 18x - 3 \\&= 7 + 10x\end{aligned}$$

23. **C** Expand and Factorise (244897)

$$\begin{aligned}2(x+4) &= 2 \times x + 2 \times 4 \\&= 2x + 8\end{aligned}$$

24. **C** Expand and Factorise (244900)

$$\begin{aligned}2(3b-5) &= 2 \times 3b + 2 \times (-5) \\&= 6b - 10\end{aligned}$$

25. **C** Expand and Factorise (244902)

$$\begin{aligned}5(2x+1) &= 5 \times 2x + 5 \times 1 \\&= 10x + 5\end{aligned}$$

26. **C** Expand and Factorise (245521)

a. $4x^2 - 2x = 2x \times 2x + 2x \times (-1)$ (HCF = $2x$)

$$= 2x(2x - 1)$$

b. $-6ab + 3a = -3a \times 2b - 3a \times (-1)$ (HCF = $-3a$)

$$= -3a(2b - 1)$$

c. $-5q - 10q^2 = -5q \times 1 - 5q \times 2q$ (HCF = $-5q$)

$$= -5q(1 + 2q)$$

27. **C** Expand and Factorise (245463)

Listing factors in pairs $\rightarrow (1, -12y)(2, -6y)(3, -4y)(4, -3y)(6, -2y)(12, -y)$

$(-1, 12y)(-2, 6y)(-3, 4y)(-4, 3y)(-6, 2y)(-12, y)$

$\therefore$ Factors are:

$1, 2, 3, 4, 6, 12, -y, -2y, -3y, -4y, -6y, -12y$

$-1, -2, -3, -4, -6, -12, y, 2y, 3y, 4y, 6y, 12y$

28.

C

 Expand and Factorise (246232)

$$2mn^2 + 6m^2n - 8mn = 2mn \times n + 2mn \times 3m + 2mn \times (-4) \quad (\text{HCF} = 2mn)$$
$$= 2mn(n + 3m - 4)$$

29.

C

 Expand and Factorise (246235)

$$24p^2qr^3 + 18p^3q^2 + 6p^2qr^2 = 6p^2q \times 4r^3 + 6p^2q \times 3pq + 6p^2q \times r^2 \quad (\text{HCF} = 6p^2q)$$
$$= 6p^2q(4r^3 + 3pq + r^2)$$

30.

C

 Expand and Factorise (245423)

Listing factors in pairs $\longrightarrow (1, 4b) (2, 2b) (4, b) (-1, -4b) (-2, -2b) (-4, -b)$

$\therefore$ Factors are: 1, 2, 4, b, 2b, 4b, -1, -2, -4, -b, -2b, -4b

31.

C

 Expand and Factorise (246075)

$$9a^2 - 6a = 3a \times 3a + 3a \times (-2) \quad (\text{HCF} = 3a)$$
$$= 3a(3a - 2)$$

$\therefore$ Width of rectangle = 3a - 2

32.

C

 Expand and Factorise (245448)

Listing factors in pairs $\longrightarrow (1, 10m)(2, 5m)(5, 2m)(10, m)(-1, -10m)(-2, -5m)(-5, -2m)$

$\therefore$ Factors are:
1, 2, 5, 10, m, 2m, 5m, 10m
-1, -2, -5, -10, -m, -2m, -5m, -10m

33.

C

 Expand and Factorise (246227)

$$9a^2 - 6a = 3a \times 3a + 3a \times (-2) \quad (\text{HCF} = 3a)$$
$$= 3a(3a - 2)$$

$\therefore$ Width of rectangle = 3a - 2

34.

C

 Expand and Factorise (244905)

$$4\left(\frac{x}{2} + 3\right) = 4 \times \frac{x}{2} + 4 \times 3$$
$$= \frac{4x}{2} + 12$$
$$= 2x + 12$$

35.

C

 Expand and Factorise (246230)

$$2pq^2 + 4pq^2 = 2pq \times q + 2pq \times 2p \quad (\text{HCF} = 2pq)$$
$$= 2pq(q + 2p)$$

$\therefore$ Length of rectangle = q + 2p

36.

B

 Expand and Factorise (244918)

$$x(x + y) = x \times x + x \times y$$
$$= x^2 + xy$$

37.

B

 Expand and Factorise (244924)

$$x(40 + y) = x \times 40 + x \times y$$
$$= 40x + xy$$

38.

B

 Expand and Factorise (244910)

$$4(3 + b) = 4 \times 3 + 4 \times b$$
$$= 12 + 4b$$

39.

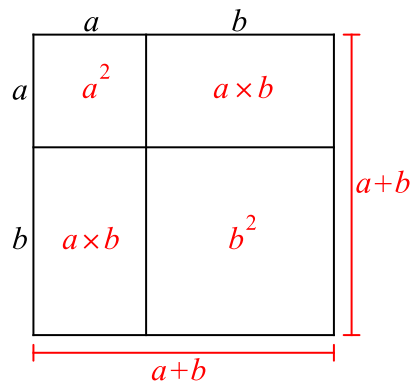
B

 Expand and Factorise (245041)

Area of Triangle = $\frac{1}{2} \times \text{base} \times \text{height}$

$$= \frac{1}{2} \times (2 + 6m) \times m$$
$$= \frac{m}{2}(2 + 6m)$$
$$= \frac{m}{2} \times 2 + \frac{m}{2} \times 6m$$
$$= m + 3m^2$$

40. **A** Expand and Factorise (245065)



Length of large rectangle = $a + b$

Width of large rectangle = $a + b$

$$\begin{aligned}\text{Area of large rectangle} &= (a + b) \times (a + b) \\ &= (a + b)^2\end{aligned}$$

$$\begin{aligned}\text{Adding 4 areas inside large rectangle} &= a^2 + a \times b + a \times b + b^2 \\ &= a^2 + 2ab + b^2\end{aligned}$$

$$\therefore (a + b)^2 = a^2 + 2ab + b^2$$

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MATHEMATICS

Stage 4

Number and Algebra, Algebraic Techniques

Algebraic Fractions

Teacher: Chi Binh Le

Exam Equivalent Time: 85.5 minutes (based on allocation ~1.25 min/mark)

Questions

1. B+ Algebraic Fractions (244433)

$\frac{a}{4}$ is equivalent to:

- A. $\frac{4a}{a}$
- B. $\frac{3a}{12}$
- C. $\frac{a^2}{4a^3}$
- D. $\frac{a^4}{a^3}$

2. B+ Algebraic Fractions (244427)

$\frac{x}{3}$ is equivalent to:

- A. $\frac{2x}{6}$
- B. $x + \frac{1}{3}$
- C. $\frac{12x}{4}$
- D. $\frac{x^3}{x^2}$

3. B+ Algebraic Fractions (244437)

$\frac{2}{m}$ is equivalent to:

- A. $\frac{4}{8m}$
- B. $\frac{3m}{12}$
- C. $\frac{6m}{3m^2}$
- D. $\frac{1}{m} + \frac{1}{m}$

4. B+ Algebraic Fractions (244504)

Simplify the following products, giving your answer as an algebraic fraction in simplest form.

- a. $\frac{a}{2} \times \frac{1}{5}$ (1 mark)
- b. $\frac{3x}{5} \times \frac{2y}{7}$ (1 mark)
- c. $\frac{5r}{9} \times \frac{4s}{5}$ (2 marks)

5. A Algebraic Fractions (244468)

For the difference $\frac{5r}{8} - \frac{3r}{8}$, simplify and write an equivalent algebraic fraction. (2 marks)

6. A Algebraic Fractions (244806)

Simplify the following products, giving your answer as an algebraic fraction in simplest form.

- a. $\frac{5}{y} \div \frac{4}{x}$ (1 mark)
- b. $\frac{9a}{7} \div \frac{c}{b}$ (1 mark)
- c. $\frac{r}{3} \div \frac{5}{4s}$ (2 marks)

7. A Algebraic Fractions (244462)

For the difference $\frac{a}{4} - \frac{a}{5}$, simplify and write an equivalent algebraic fraction. (2 marks)

8. A Algebraic Fractions (244445)

For the sum $\frac{a}{4} + \frac{a}{2}$, simplify and write an equivalent algebraic fraction. (2 marks)

9. **A** Algebraic Fractions (244466)

For the difference $\frac{m}{2} - \frac{m}{7}$, simplify and write an equivalent algebraic fraction. *(2 marks)*

10. **A** Algebraic Fractions (244452)

For the sum $\frac{b}{3} + \frac{5b}{6}$, simplify and write an equivalent algebraic fraction. *(2 marks)*

11. **A** Algebraic Fractions (244459)

For the difference $\frac{2x}{3} - \frac{x}{4}$, simplify and write an equivalent algebraic fraction. *(2 marks)*

12. **A** Algebraic Fractions (244816)

Simplify $\frac{3x}{2} \times \frac{8}{5x} \div \frac{4}{x}$ giving your answer as an algebraic fraction in simplest form. *(2 marks)*

13. **A** Algebraic Fractions (244512)

Simplify the following products, giving your answer as an algebraic fraction in simplest form.

- a. $\frac{2b}{3} \times \frac{9c}{5}$ *(2 marks)*
- b. $\frac{8x}{5} \times \frac{25y}{12}$ *(2 marks)*

14. **A** Algebraic Fractions (244442)

For the sum $\frac{m}{3} + \frac{m}{2}$, simplify and write an equivalent algebraic fraction. *(2 marks)*

15. **A** Algebraic Fractions (244447)

For the sum $\frac{2x}{3} + \frac{x}{5}$, simplify and write an equivalent algebraic fraction. *(2 marks)*

16. **A** Algebraic Fractions (244797)

Simplify the following quotients, giving your answer as an algebraic fraction in simplest form.

- a. $\frac{5m}{8} \div \frac{m}{4}$ *(2 marks)*
- b. $\frac{14x}{3} \div \frac{7y}{6}$ *(2 marks)*

17. **A+** Algebraic Fractions (244475)

For the sum $a + \frac{a}{4}$, simplify and write an equivalent algebraic fraction. *(2 marks)*

18. **A+** Algebraic Fractions (244456)

For the sum $\frac{a}{2} + \frac{a}{3} + \frac{a}{4}$, simplify and write an equivalent algebraic fraction. *(3 marks)*

19. **A+** Algebraic Fractions (244482)

Yesterday Gareth walked x kilometres in Kosciuszko National park.
He started at Thredbo village and walked up Merritts Nature Track to the Kosciuszko express chairlift.
When he arrived at the chairlift he had complete $\frac{1}{5}$ of the total distance.

Gareth then joined a walking group and walked a further $\frac{1}{3}$ of the total distance before beginning his descent back to the village.

- a. Write an algebraic fraction to represent the distance he walked to the Kosciuszko express chairlift. *(1 mark)*
- b. Write an algebraic fraction to represent the distance he walked with the walking group. *(1 mark)*
- c. Using part (a) and (b) above, write a simplified algebraic fraction to represent the total distance Gareth covered in the first two legs of his walk. *(2 marks)*

20. **A+** Algebraic Fractions (244502)

For the expression $\frac{a}{2} + \frac{2a}{3} - \frac{a}{4}$, simplify and write an equivalent algebraic fraction. *(3 marks)*

21. **A+** Algebraic Fractions (244495)

Ben recieved ~~\$x~~ for his birthday.
He spent $\frac{1}{2}$ of his money on shoes and $\frac{1}{3}$ on Gold Class movie tickets.

- a. Write an algebraic fraction to represent the amount he spent on shoes. *(1 mark)*
- b. Write an algebraic fraction to represent the amount he spent on movie tickets. *(1 mark)*
- c. Using part (a) and (b) above, write a simplified algebraic fraction to represent the total amount of money he has spent so far. *(2 marks)*

22. **A+** Algebraic Fractions (244471)

For the difference $\frac{a}{3} - \frac{b}{4}$, simplify and write an equivalent algebraic fraction. *(3 marks)*

Worked Solutions

1. **B+** Algebraic Fractions (244433)

Consider Option B:

$$\begin{aligned}\frac{3a}{12} &= \frac{3 \times a}{3 \times 4} \\ &= \frac{a}{4} \\ \Rightarrow B\end{aligned}$$

2. **B+** Algebraic Fractions (244427)

Consider Option A:

$$\begin{aligned}\frac{2x}{6} &= \frac{2 \times x}{2 \times 3} \\ &= \frac{x}{3} \\ \Rightarrow A\end{aligned}$$

3. **B+** Algebraic Fractions (244437)

Consider Option C:

$$\begin{aligned}\frac{6m}{3m^2} &= \frac{3 \times 2 \times m}{3 \times m \times m} \\ &= \frac{2}{m} \\ \Rightarrow C\end{aligned}$$

4. **B+** Algebraic Fractions (244504)

$$\begin{aligned}\text{a. } \frac{a}{2} \times \frac{1}{5} &= \frac{a \times 1}{2 \times 5} = \frac{a}{10} \\ \text{b. } \frac{3x}{5} \times \frac{2y}{7} &= \frac{3x \times 2y}{5 \times 7} = \frac{6xy}{35} \\ \text{c. } \frac{5r}{9} \times \frac{4s}{5} &= \frac{5r \times 4s}{9 \times 5} = \frac{4rs}{9}\end{aligned}$$

5. **A** Algebraic Fractions (244468)

$$\begin{aligned}\frac{5r}{8} - \frac{3r}{8} &= \frac{2r}{8} \\ &= \frac{r}{4}\end{aligned}$$

6. **A** Algebraic Fractions (244806)

$$\begin{aligned}\text{a. } \frac{5}{y} \div \frac{4}{x} &= \frac{5}{y} \times \frac{x}{4} \\ &= \frac{5x}{4y} \\ \text{b. } \frac{9a}{7} \div \frac{c}{b} &= \frac{9a}{7} \times \frac{b}{c} \\ &= \frac{9ab}{7c} \\ \text{c. } \frac{r}{3} \div \frac{5}{4s} &= \frac{r}{3} \times \frac{4s}{5} \\ &= \frac{4rs}{15}\end{aligned}$$

7. **A** Algebraic Fractions (244462)

$$\begin{aligned}\frac{a}{4} - \frac{a}{5} &= \frac{a}{4} \times \frac{5}{5} - \frac{a}{5} \times \frac{4}{4} \\ &= \frac{5a}{20} - \frac{4a}{20} \\ &= \frac{a}{20}\end{aligned}$$

8. **A** Algebraic Fractions (244445)

$$\begin{aligned}\frac{a}{4} + \frac{a}{2} &= \frac{a}{4} + \frac{a}{2} \times \frac{2}{2} \\ &= \frac{a}{4} + \frac{2a}{4} \\ &= \frac{3a}{4}\end{aligned}$$

9. **A** Algebraic Fractions (244466)

$$\begin{aligned}\frac{m}{2} - \frac{m}{7} &= \frac{m}{2} \times \frac{7}{7} - \frac{m}{7} \times \frac{2}{2} \\ &= \frac{7m}{14} - \frac{2m}{14} \\ &= \frac{5m}{14}\end{aligned}$$

10. **A** Algebraic Fractions (244452)

$$\begin{aligned}\frac{b}{3} + \frac{5b}{6} &= \frac{b}{3} \times \frac{2}{2} + \frac{5b}{6} \\ &= \frac{2b}{6} + \frac{5b}{6} \\ &= \frac{7b}{6}\end{aligned}$$

11. **A** Algebraic Fractions (244459)

$$\begin{aligned}\frac{2x}{3} - \frac{x}{4} &= \frac{2x}{3} \times \frac{4}{4} - \frac{x}{4} \times \frac{3}{3} \\ &= \frac{8x}{12} - \frac{3x}{12} \\ &= \frac{5x}{12}\end{aligned}$$

12. **A** Algebraic Fractions (244816)

$$\begin{aligned}\frac{3x}{2} \times \frac{8}{5x} \div \frac{4}{x} &= \frac{3x}{2} \times \frac{8}{5x} \times \frac{x}{4} \\ &= \frac{3x}{5}\end{aligned}$$

13. **A** Algebraic Fractions (244512)

$$\begin{aligned}\text{a. } \frac{2b}{3} \times \frac{9c}{5} &= \frac{2b \times 9c}{3 \times 5} \\ &= \frac{18bc \div 3}{15 \div 3} \\ &= \frac{6bc}{5}\end{aligned}$$

$$\begin{aligned}\text{b. } \frac{8x}{5} \times \frac{25y}{12} &= \frac{8x \times 25y}{5 \times 12} \\ &= \frac{200xy \div 20}{60 \div 20} \\ &= \frac{10xy}{3}\end{aligned}$$

14. **A** Algebraic Fractions (244442)

$$\begin{aligned}\frac{m}{3} + \frac{m}{2} &= \frac{m}{3} \times \frac{2}{2} + \frac{m}{2} \times \frac{3}{3} \\ &= \frac{2m}{6} + \frac{3m}{6} \\ &= \frac{5m}{6}\end{aligned}$$

15. **A** Algebraic Fractions (244447)

$$\begin{aligned}\frac{2x}{3} + \frac{x}{5} &= \frac{2x}{3} \times \frac{5}{5} + \frac{x}{5} \times \frac{3}{3} \\ &= \frac{10x}{15} + \frac{3x}{15} \\ &= \frac{13x}{15}\end{aligned}$$

16. **A** Algebraic Fractions (244797)

$$\begin{aligned}\text{a. } \frac{5m}{8} \div \frac{m}{4} &= \frac{5m}{8} \times \frac{4}{m} \\ &= \frac{20m}{8m} \\ &= \frac{5}{2}\end{aligned}$$

$$\begin{aligned}\text{b. } \frac{14x}{3} \div \frac{7y}{6} &= \frac{14x}{3} \times \frac{6}{7y} \\ &= \frac{7x \times 2 \times 3 \times 2}{7y \times 3} \\ &= \frac{4x}{y}\end{aligned}$$

17. **A+** Algebraic Fractions (244475)

$$\begin{aligned}a + \frac{a}{4} &= \frac{a}{1} \times \frac{4}{4} + \frac{a}{4} \\ &= \frac{4a}{4} + \frac{a}{4} \\ &= \frac{5a}{4}\end{aligned}$$

18. **A+** Algebraic Fractions (244456)

$$\begin{aligned}\frac{a}{2} + \frac{a}{3} + \frac{a}{4} &= \frac{a}{2} \times \frac{6}{6} + \frac{a}{3} \times \frac{4}{4} + \frac{a}{4} \times \frac{3}{3} \\ &= \frac{6a}{12} + \frac{4a}{12} + \frac{3a}{12} \\ &= \frac{13a}{12}\end{aligned}$$

19. **A+** Algebraic Fractions (244482)

a. First leg = $\frac{1}{5} \times x$
= $\frac{x}{5}$ kilometres

b. Second leg = $\frac{1}{3} \times x$
= $\frac{x}{3}$ kilometres

c. Distance travelled = $\frac{x}{5} + \frac{x}{3}$
= $\frac{x}{5} \times \frac{3}{3} + \frac{x}{3} \times \frac{5}{5}$
= $\frac{3x}{15} + \frac{5x}{15}$
= $\frac{8x}{15}$ kilometres

20. **A+** Algebraic Fractions (244502)

$$\begin{aligned}\frac{a}{2} + \frac{2a}{3} - \frac{a}{4} &= \frac{a}{2} \times \frac{6}{6} + \frac{2a}{3} \times \frac{4}{4} - \frac{a}{4} \times \frac{3}{3} \\ &= \frac{6a}{12} + \frac{8a}{12} - \frac{3a}{12} \\ &= \frac{11a}{12}\end{aligned}$$

21. **A+** Algebraic Fractions (244495)

a. Shoes = $\frac{1}{2} \times x$
= $\frac{\$x}{2}$

b. Movie tickets = $\frac{1}{3} \times x$
= $\frac{\$x}{3}$

c. Total Spent = $\frac{x}{2} + \frac{x}{3}$
= $\frac{x}{2} \times \frac{3}{3} + \frac{x}{3} \times \frac{2}{2}$
= $\frac{3x}{6} + \frac{2x}{6}$
= $\frac{\$5x}{6}$

22. **A+** Algebraic Fractions (244471)

$$\begin{aligned}\frac{a}{3} - \frac{b}{4} &= \frac{a}{3} \times \frac{4}{4} - \frac{b}{4} \times \frac{3}{3} \\ &= \frac{4a}{12} - \frac{3b}{12} \\ &= \frac{4a - 3b}{12}\end{aligned}$$