

CHAPTER 23

The work in this chapter provides a lot of extra practice in factorising quadratic expressions. It does not include those fractions which, after addition, can be further simplified by factorising the numerator and cancelling common factors. These will be covered in Book 4A.

Exercise 23a (p. 386)

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|------------------|-------------------|-------------------|-------------------|--------------------|--------------------|
| 1. $\frac{x}{4}$ | 4. $\frac{a}{b}$ | 7. $\frac{a}{2c}$ | 10. $\frac{a}{c}$ | 13. $\frac{b}{d}$ | 16. $\frac{2}{3y}$ |
| 2. $\frac{a}{2}$ | 5. $\frac{x}{y}$ | 8. $\frac{2}{q}$ | 11. $\frac{a}{2}$ | 14. $\frac{1}{3x}$ | 17. $\frac{m}{k}$ |
| 3. $\frac{p}{q}$ | 6. $\frac{1}{2a}$ | 9. $\frac{pq}{2}$ | 12. $\frac{z}{2}$ | 15. $\frac{q}{2}$ | 18. $\frac{s}{4t}$ |

Exercise 23b (p. 388)

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|------------------------|----------------------|--------------------------|
| 1. $\frac{1}{x}$ | 7. $p - q$ | 13. $\frac{2a}{3(a-b)}$ |
| 2. $\frac{t}{s-t}$ | 8. $\frac{1}{(4-a)}$ | 14. $\frac{2(x-y)}{3xy}$ |
| 3. Not possible | 9. Not possible | 15. Not possible |
| 4. Not possible | 10. $\frac{1}{v}$ | 16. $u - v$ |
| 5. $\frac{x}{2(x-y)}$ | 11. $\frac{y}{x+y}$ | 17. Not possible |
| 6. $\frac{(a+b)}{2ab}$ | 12. $\frac{1}{2}$ | 18. $\frac{1}{(s-6)}$ |

Exercise 23c (p. 389)

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|-----------------------|----------------------|---------------------|
| 1. $\frac{2a}{4a-b}$ | 12. $\frac{p+q}{5}$ | 23. $\frac{3}{x+3}$ |
| 2. $\frac{2q}{p-q}$ | 13. $\frac{1}{3}$ | 24. $\frac{9}{y+2}$ |
| 3. $\frac{1}{a}$ | 14. $\frac{3+a}{4b}$ | 25. $\frac{y}{x-2}$ |
| 4. $\frac{3}{5}$ | 15. $\frac{2-y}{x}$ | 26. $\frac{q}{p+2}$ |
| 5. $\frac{2-x}{3y}$ | 16. $\frac{1}{3y}$ | 27. $\frac{t}{s-7}$ |
| 6. $\frac{a}{3-b}$ | 17. a | 28. $\frac{1}{p+3}$ |
| 7. $\frac{1}{3a}$ | 18. $\frac{p}{2}$ | 29. $\frac{1}{x+6}$ |
| 8. s | 19. $\frac{1}{a-2}$ | 30. $\frac{2}{x-4}$ |
| 9. $\frac{3}{a}$ | 20. $\frac{1}{x-4}$ | 31. $\frac{3}{x-4}$ |
| 10. $\frac{2x}{3x-y}$ | 21. $\frac{1}{y+2}$ | 32. $\frac{v}{u+6}$ |
| 11. $\frac{3a}{a+b}$ | 22. $\frac{2}{a+3}$ | 33. $\frac{y}{x-2}$ |

Exercise 23d (p. 391)

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|-----------------------|-----------------------|------------------------|------------------------|
| 1. $\frac{x+3}{2x-1}$ | 4. $\frac{1}{2-x}$ | 7. $\frac{x-y}{3x-2y}$ | 10. $\frac{y+3}{2y+1}$ |
| 2. $\frac{4}{x+2}$ | 5. $\frac{a+b}{a-b}$ | 8. $\frac{2-x}{y}$ | 11. $\frac{x-3y}{x}$ |
| 3. $\frac{2x-1}{x-2}$ | 6. $\frac{a+b}{2a+b}$ | 9. $-a$ | 12. $\frac{4x+1}{4x}$ |

13. $\frac{2x-3}{x-5}$

14. $\frac{-1}{1+a}$

15. $a+b$

16. $\frac{-(x+5)}{(x+1)}$

17. $\frac{2(2x-1)}{x-3}$

18. $\frac{x-2y}{y}$

19. $\frac{1-x}{3(x+2)}$

20. $\frac{1+y}{x+y}$

Exercise 23e (p. 392)

1. $\frac{ac}{bd}$

2. $\frac{ad}{bc}$

3. $\frac{5(x-y)}{2x}$

4. $\frac{x(x-y)}{10}$

5. $\frac{a}{bc}$

6. $\frac{ac}{b}$

7. $\frac{3(a-b)}{4(a+b)}$

8. $\frac{(x-2)(x+3)}{3}$

9. $\frac{x-2}{3(x+3)}$

10. $\frac{pr}{q}$

11. $\frac{6b}{a}$

12. $\frac{q}{2p}$

13. $\frac{12y}{x}$

14. $\frac{2b^2}{5}$

15. $\frac{pq}{6}$

16. $\frac{x}{2y}$

17. $\frac{1}{2b}$

18. $\frac{2}{3p}$

19. $\frac{a}{4b}$

20. $\frac{a^3}{b^3}$

21. $\frac{1}{4(b-2)}$

22. $2(x-2)$

23. $2(a+3)$

24. 6

25. $x-3$

26. $x-3$

27. $\frac{1}{x-2}$

28. $\frac{2}{x+4}$

29. $\frac{3(x-2)}{5(x+6)}$

30. $\frac{2(2x-3)}{9}$

31. $\frac{3}{3x+2}$

32. $\frac{2x-3}{2}$

33. $\frac{2x-1}{6x+1}$

34. a

35. $\frac{-c(a+b)}{b}$

36. $(x-4)(x-2)$

Exercise 23f (p. 395)

A reminder, with explanation, is needed yet again that, for example, a cannot be cancelled in $\frac{3}{ab} + \frac{a}{2}$. Numerical examples show this clearly,

e.g. $\frac{1}{2} + \frac{4}{5}$ is *not* $1\frac{2}{5}$. ($\frac{1}{2} + \frac{4}{5} \neq 1\frac{2}{5}$!).

1. pq

2. rst

3. 30

4. abc

5. $wxyz$

6. ad

7. uvw

8. 168

9. pqr

10. xy

11. $2x^2$

12. $3pq$

13. $2x^2y$

14. abc

15. st

16. $3p^2$

17. $5ab$

18. $3pq^2$

19. $6x$

20. $8x$

21. $18a$

22. 60

23. a^2b

24. $30x$

25. $12x$

26. $15y$

27. $12x$

Exercise 23g (p. 396)

1. $\frac{x+y}{xy}$

2. $\frac{3q-2p}{pq}$

3. $\frac{2t-s}{st}$

4. $\frac{6b+a}{2ab}$

5. $\frac{5y-6x}{15xy}$

6. $\frac{2b+5a}{2ab}$

7. $\frac{2y-3x}{xy}$

8. $\frac{4q+6p}{3pq}$

9. $\frac{3y-2x}{xy}$

10. $\frac{20b+21a}{28ab}$

11. $\frac{5}{6x}$

12. $-\frac{1}{35x}$

13. $\frac{5}{4y}$

14. $\frac{1}{8p}$

15. $\frac{13}{8a}$

16. $\frac{4}{21x}$

17. $\frac{6}{35x}$

18. $\frac{1}{3y}$

19. $\frac{3a+2b}{4ab}$

20. $\frac{ab-2a^2}{2b^2}$

21. $\frac{3y-4}{xy}$

22. $\frac{4+3p}{2p^2}$

23. $\frac{9a^2+2b^2}{12ab}$

24. $\frac{10q-3p}{4pq}$

25. $\frac{2s+ts^2}{2t^2}$

26. $\frac{15b+4}{6ab}$

27. $\frac{3+2x}{3x^2}$

28. $\frac{4y^2-9x^2}{6xy}$

29. $\frac{5y-4x}{8xy}$

30. $\frac{pq^2+3p^2}{3q^2}$

31. $\frac{10y-3}{14xy}$

32. $\frac{18b-3a}{2a^2b}$

33. $\frac{3x^2-3y^2}{2xy}$

34. $\frac{14q-15p}{18pq}$

35. $\frac{5a^2-4ab}{5b^2}$

36. $\frac{21+8p}{15pq}$

Exercise 23h (p. 398)

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|-----------------------|-------------------------|-------------------------|---------------------------|------------------------------|
| 1. $\frac{9x+3}{20}$ | 8. $\frac{5x-3}{42}$ | 15. $\frac{10-5x}{6}$ | 22. $\frac{42x-49}{10}$ | 29. $\frac{7x-4}{2x(x-4)}$ |
| 2. $\frac{5-x}{12}$ | 9. $\frac{5-22x}{21}$ | 16. $\frac{31x-6}{24}$ | 23. $\frac{27x+3}{14}$ | 30. $\frac{2x-3}{4x(2x+1)}$ |
| 3. $\frac{13x+1}{15}$ | 10. $\frac{7x+9}{12}$ | 17. $\frac{11-7x}{10}$ | 24. $\frac{19x-73}{9}$ | 31. $\frac{5a+12}{a(a+4)}$ |
| 4. $\frac{4x+13}{12}$ | 11. $\frac{22-13x}{6}$ | 18. $\frac{2-11x}{18}$ | 25. $\frac{26x-18}{15}$ | 32. $\frac{7x-4}{x(x-1)}$ |
| 5. $\frac{1-2x}{35}$ | 12. $\frac{11-7x}{12}$ | 19. $\frac{26x+34}{15}$ | 26. $\frac{-17x+104}{30}$ | 33. $\frac{11x+1}{3x(2x+1)}$ |
| 6. $\frac{7x-3}{10}$ | 13. $\frac{20-17x}{24}$ | 20. $\frac{17x-1}{12}$ | 27. $\frac{3a+6}{a(a+3)}$ | 34. $\frac{21x-6}{5x(2x+3)}$ |
| 7. $\frac{3x+9}{35}$ | 14. $\frac{22-7x}{20}$ | 21. $\frac{5x-19}{21}$ | 28. $\frac{6x+4}{x(x+2)}$ | |

Exercise 23i (p. 401)

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|-----------------------|--------------------------|------------------------------|-----------------------------|
| 1. $\frac{2c-ab}{ac}$ | 7. $\frac{-p}{p+q}$ | 13. $\frac{3}{10x^2}$ | 19. $\frac{19x-1}{3x(x-1)}$ |
| 2. $\frac{qr^2}{p}$ | 8. $\frac{12-2x}{3x^2}$ | 14. $\frac{4x+7}{10}$ | 20. $\frac{2}{x(x-1)}$ |
| 3. $\frac{7x-14}{12}$ | 9. $\frac{1-2x}{x(x+1)}$ | 15. $\frac{(x+4)(2x-1)}{50}$ | 21. $\frac{-a-3}{2a(a-1)}$ |
| 4. $\frac{a}{a-b}$ | 10. $\frac{ab}{c}$ | 16. $\frac{25}{12x}$ | 22. $\frac{3}{a(a-1)}$ |
| 5. $\frac{1}{12x}$ | 11. $\frac{8}{15}$ | 17. $\frac{25}{24x^2}$ | 23. $\frac{3}{y}$ |
| 6. $\frac{1}{x+2}$ | 12. $\frac{23}{20x}$ | 18. $\frac{3}{2}$ | 24. -1 |

Exercise 23j (p. 402)

Remind pupils of the difference between an equation and an expression.

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|-------------------|---------------------|----------------------|-----------------------|---------------------------------|
| 1. 8 | 10. $8\frac{3}{4}$ | 19. 2 | 28. $-3, -3$ | 37. -40 |
| 2. -5 | 11. 2 | 20. 4 | 29. 1, 1 | 38. $\frac{2}{5}$ |
| 3. 6 | 12. -18 | 21. 1 | 30. $\frac{2}{3}, 1$ | 39. 0, 4 |
| 4. $1\frac{1}{3}$ | 13. 3 | 22. $-2\frac{1}{19}$ | 31. $2, -\frac{2}{3}$ | 40. 3 |
| 5. 10 | 14. -1 | 23. $-2, -1$ | 32. $-2, -1$ | 41. $\frac{1}{2}, -\frac{1}{2}$ |
| 6. 5 | 15. 21 | 24. 3, 2 | 33. $4\frac{1}{2}$ | 42. 3 |
| 7. $9\frac{3}{5}$ | 16. $\frac{4}{9}$ | 25. $-2, -2$ | 34. $\frac{2}{5}$ | |
| 8. $5\frac{1}{4}$ | 17. $-2\frac{1}{2}$ | 26. $-3, -3$ | 35. 2, 1 | |
| 9. -1 | 18. -17 | 27. 1, -4 | 36. $-2\frac{4}{5}$ | |

Exercise 23k (p. 405)

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|----------------------|---------------------|----------|------------------------|--------------------|
| 1. a) $\frac{b}{2}$ | b) a | c) $a-b$ | 4. a) $\frac{5x-7}{6}$ | b) $1\frac{7}{10}$ |
| 2. a) $\frac{4}{3x}$ | b) $\frac{1}{3x^2}$ | c) 3 | | |
| 3. a) -13 | b) 3, -1 | | | |

Exercise 23l (p. 406)

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|----------------------|---------------------|----------|----------------------|----------|--------------------|
| 1. a) $\frac{2x}{y}$ | b) $\frac{x-y}{2x}$ | c) $x+3$ | 2. a) $\frac{1}{6p}$ | b) $x-2$ | c) $\frac{3y}{2x}$ |
|----------------------|---------------------|----------|----------------------|----------|--------------------|

3. a) $\frac{8}{9}$ b) 7, -2

4. a) $\frac{x^2-2x+12}{4x}$ b) $6\frac{1}{2}$

Exercise 23m (p. 406)

1. a) $\frac{v}{uw}$ b) $\frac{1}{2a-b}$ c) $\frac{x}{3-x}$

3. a) 4 b) 1, 2

2. a) $18s^2$ b) $2(x-2)$ c) $\frac{2-5x}{x(4x-1)}$

4. a) $\frac{x}{6}$ b) 30