1. Simplify fully

(i) $(p^3)^3$

....

(ii) $\dfrac{3q^4 \times 2q^5}{q^3}$

....

(Total 3 marks)

2. Simplify fully

(a) $2(3x + 4) - 3(4x - 5)$

....

(2)

(b) $(2xy^3)^5$

....

(2)

(c) $\frac{n^2 - 1}{n + 1} \times \frac{2}{n - 2}$

....

(3)
(Total 7 marks)

3. (a) Factorise

$$9x^2 - 6x + 1$$

....

(2)

(b) Simplify

$$\frac{6x^2 + 7x - 3}{9x^2 - 6x + 1}$$

....

(3)
(Total 5 marks)

4. (a) Factorise $x^2 - 3x$

....

(2)

(b) Simplify $k^5 \div k^2$

....

(1)

(c) Expand and simplify

(i) $4(x + 5) + 3(x - 7)$

....

(ii) $(x + 3y)(x + 2y)$

....

(4)

(d) Factorise $(p + q)^2 + 5(p + q)$

....
(1)
(Total 8 marks)

5. (a) Solve $\dfrac{40 - x}{3} = 4 + x$

x = ...
(3)

(b) Simplify fully $\dfrac{4x^2 - 6x}{4x^2 - 9}$

....
(3)
(Total 6 marks)

6. Simplify $$\frac{4x^2 - 9}{2x^2 - 5x + 3}$$

....

(Total 3marks)

7. (a) Simplify $a^3 \times a^4$

....

(1)

(b) Simplify $3x^2y \times 5xy^3$

....

(2)

(c) Simplify $\frac{(x-1)^2}{x-1}$

……………………

(1)

(d) Factorise $a^2 - 9b^2$

……………………

(2)
(Total 6 marks)

8. Simplify fully

(a) $(3xy^2)^4$

……………………

(2)

(b) $\frac{x^2 - 3x}{x^2 - 8x + 15}$

……………………

(3)
(Total 5 marks)

9. (a) Simplify

(i) $(3x^2y)^3$

....

(ii) $(2t^{-3})^{-2}$

....

(4)

(b) Show that $x^2 - 4x + 15$ can be written as $(x + p)^2 + q$ for all values of x.
State the values of p and q.

p = ...

q = ...

(3)
(Total 7 marks)

10. Simplify fully $\dfrac{25 - x^2}{25 + 5x}$

....

(Total 3 marks)

11. (a) Simplify

(i) $x^4 \times x^5$

....

(ii) $\dfrac{p^8}{p^3}$

....

(iii) $3s^2 t^3 \times 4s^4 t^2$

....

(iv) $(q^3)^4$

....

(5)

(b) Expand $3(2g - 1)$

....

(1)

(c) Expand $2d(d + 3)$

....

(2)

(d) Expand and simplify $(x + 2)(x + 3)$

....

(2)
(Total 10 marks)

12. (a) Simplify fully $(3x^2y^4)^3$

....

(2)

(b) Expand and simplify $(2x + 5)(3x - 2)$

....

(2)

(c) Simplify fully $\dfrac{x^2 + 5x + 6}{x^2 + 2x}$

....

(2)
(Total 6 marks)

13. (a) Expand $x(3 - 2x^2)$

....

(2)

(b) Factorise completely $12xy + 4x^2$

....

(2)

(c) Simplify $\dfrac{20a^2}{4ab^2}$

....

(2)

(d) Simplify $\dfrac{x-3}{x^2-9}$

....

(2)

(Total 8 marks)

14. (a) Expand and simplify $(x + 3)(x - 4)$

....

(2)

(b) Expand and simplify $(2x + 5)(3x – 4)$

....
(2)

(c) Factorise $x^2 + 7x + 10$

....
(2)

(d) Simplify fully $3p^5q \times 4p^3q^2$

....
(2)

(e) $p = 3t + 4(q – t)$

Find the value of q when $p = 6$ and $t = 5$

q = ...
(3)
(Total 11 marks)

15. (a) Simplify

$$12y^3 \div 3y^5$$

....
(2)

(b) Simplify

$$2w^3x^2 \times 3w^4x$$

....
(2)
(Total 4 marks)

16. (a) Expand and simplify

$$(x - 6)(x + 4)$$

....
(2)

(b) Factorise completely

$$12x^2 - 18xy$$

....
(2)
(Total 4 marks)

17. (a) Simplify fully

$$\frac{2x^2 - 3x}{4x^2 - 9}$$

....

(Total 3 marks)

18. Simplify

$$\frac{x^2(5+x)}{x^2-25}$$

……………………

(Total 2 marks)

19. (a) Simplify $k^5 \div k^2$

....

(1)

(b) Expand and simplify $4(x + 5) + 3(x - 7)$

....

(2)

(Total 3 marks)

20. (a) Simplify $p^8 \div p^2$

....

(1)

(b) Simplify $(w^4)^3$

....

(1)

(c) Simplify $5e^3f \times e^2f^2$

....

(2)
(Total 4 marks)

21. (a) Simplify $x^4 \div x^9$

....

(1)

(b) Simplify $3w^5y^2 \times 4w^3y^4$

....

(2)
(Total 3 marks)

22. Simplify fully $\dfrac{3(2x+1)}{4x^2-1}$

....

(Total 2 marks)

23. (i) $3s^2t^3 \times 4s^4t^2$

....

(ii) $(q^3)^4$

....

(Total 2 marks)

24. Expand and simplify $(2x + 5)(3x - 2)$

....

(Total 2 marks)

25. Simplify fully $\dfrac{3x+6}{x^2-4}$

....

(Total 3 marks)

26. (a) Simplify $4e \times 3f$

....

(1)

(b) Factorise $5x + 15$

....

(1)

(c) Simplify $2(r + 3) + 3(2r + 1)$

....

(2)

(Total 4 marks)

27. Expand and simplify $(3x - 5)(x + 1)$

....
(Total 2 marks)

28. Write as a single fraction $\dfrac{4}{x(x+3)} + \dfrac{5}{(x+3)}$

....
(Total 2 marks)

29. (a) Factorise $8p - 6$

....
(1)

(b) Factorise completely $y^3 - y^2$

....

(2)

(c) Expand and simplify $(e + 3)(e + 4)$

....

(2)

(Total 5 marks)

30. Simplify $\dfrac{x^2 + 5x + 6}{x + 2}$

....

(Total 3 marks)

31. Prove that $(n + 2)^2 - (n - 2)^2 = 8n$ for all values of n.

(Total 2 marks)

....

(Total 3 marks)

32. (a) Expand $3(5p - 2)$

....

(1)

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

....

(2)

(c) Factorise $a^2 - 16a + 64$

....

(2)
(Total 5 marks)

33. Write $\dfrac{x}{x-2} - \dfrac{3}{x(x-2)}$ as a single fraction in its simplest form.

....

(Total 2 marks)

34. Write as a single fraction in its simplest form

$$\frac{4}{x+5}+\frac{1}{x-3}$$

....

(Total 4 marks)

35. Expand and simplify $3(2x + 5) + 4(3x + 1)$

....

(Total 2 marks)

36. Expand and simplify $(3x + 4)(5x - 1)$

....

(Total 2 marks)

37. Simplify fully $\dfrac{4a-20}{a^2-25}$

....

(Total 3 marks)

38. Expand and simplify

$(x + 3y)(x - 4y)$

$x^2 + xy - 7y^2$	$x^2 - xy - 12y^2$	$x + xy - 12y$	$x^2 + xy - 12y^2$	$x^2 - 7xy - 12y^2$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

39. Simplify $(2a^2 b)^3$

$6a^5b$	$6a^6b^3$	$8a^6b^3$	$6a^5b^3$	$8a^5b^3$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

40. Expand $(2x + 5y)(3x - 2y)$

$5x^2 + 8xy - 7y^2$	$6x^2 + 12xy - 10y^2$	$5x^2 + 4xy - 7y^2$	$6x^2 - 4xy - 10y^2$	$6x^2 + 11xy - 10y^2$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

41. Expand and simplify $(2x - 5)^2$

$100x^2$	$4x^2 - 25$	$4x^2 + 25$	$4x^2 - 20 + 25$	$4x^2 + 20x + 25$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

42. (a) Expand and simplify $(y + 2)(y + 3)$

....

(2)

(b) Simplify $\dfrac{3(x-2)}{x^2 - 7x + 10}$

....

(2)

(Total 4 marks)

43. $(2x + 3)^2 - (2x + 3)(x - 1) =$

$(2x + 3)(x + 2)$	$x + 6$	$2x^2 + x + 6$	$2x^2 - x + 12$	$(2x + 3)(x + 4)$
A	**B**	**C**	**D**	**E**

(Total 1 mark)

1. (i) p^9 1

B1 cao

(ii) $6q^6$ 2

B2 for $6q^6$

(B1 for sight of $\frac{6q^9}{q^3}$ *or* $3q \times 2q^5$ *or* $3q^4 \times 2q^2$

or $6 \times q \times q \times q \times q \times q \times q$ *or final answer of the form* kq^6, $k > 0$*)*

[3]

2. (a) $-6x + 23$ 2

$6x + 8 - 12x + 15$

M1 for 3 of the 4 terms $6x$, $+8$, $-12x$, $+15$ *correct*

A1 cao

(b) $32x^5y^{15}$ 2

B2 cao

(B1 for two of 32, x^5, y^{15}*)*

(c) $\frac{2(n-1)}{n-2}$ 3

$\frac{(n+1)(n-1)}{n+1} \times \frac{2}{n-2}$

$\frac{2(n-1)}{n-2}$

M1 for $k(n+1)(n-1)$

M1 dep for $\frac{(n+1)(n-1)}{(n+1)} = n - 1$

A1 for $\frac{2(n-1)}{n-2}$

[7]

3. (a) $(3x - 1)^2$ 2

B1 for $(3x - 1)(..x….)$ *cao*

B2 for $(3x - 1)^2$ *cao*

(b) $\dfrac{2x+3}{3x-1}$ 3

$$\frac{(3x-1)(2x+3)}{(3x-1)^2} = \frac{(2x+3)}{(3x-1)}$$

B1 for correct factorisation of numerator
M1 for cancelling of common factors
A1 cao

[5]

4. (a) $x(x-3)$ 2

B2 for x(x – 3)
(B1 for x (…….))

(b) k^3. 1

B1 for k^3.

(c) (i) $7x - 1$ 4

$4x + 20 + 3x - 21$

*M1 for **three** of 4 terms 4x + 20 + 3x – 21 (or better)*
A1 for 7x – 1

(ii) $x^2 + 5xy + 6y^2$

$x^2 + 3xy + 2xy + 6y^2$

*M1 for **three** of 4 terms* $x^2 + 3yx + 2xy + 6y^2$
A1 for $x^2 + 5xy\ 6y^2$

(d) $(p + q)(p + q + 5)$ 1

B1 for (p + q)(p + q +5)

[8]

5. (a) 7 — 3

$40 - x = 3(4 + x)$
$40 - x = 12 + 3x$
$40 - 12 = x + 3x$
$4x = 28$

M1 multiplying through by 3:
$3 \times \frac{40 - x}{3} = 3 \times 4 + 3 \times x$
A1 $40 - 12 = x + 3x$
A1 cao

(b) $\frac{2x}{2x+3}$ — 3

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

B1 for $(2x - 3)(2x + 3)$
B1 for $2x(2x - 3)$ *or* $(2x + 0)(2x + 3)$
B1 cao

[6]

6. $\frac{2x+3}{x-1}$ — 3

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

B1 for $(2x - 3)(2x + 3)$
B1for $(2x - 3)(x - 1)$
B1 cao

[3]

7. (a) a^7 — 1

B1 accept a^{4+3}

(b) $15x^3y^4$ — 2

B2 cao
(B1 for two of 15, x^3, y^4 *in a product)*

(c) $x - 1$ — 1

B1 cao

(d) $(a + 3b)(a - 3b)$ 2

B2 for (a + 3b)(a – 3b)

(B1 for (a ± 3b)(a ± 3b)

[6]

8. (a) $81x^4y^8$ 2

$3^4x^4y^8$

B2 for $81x^4y^8$

(B1 for 2 of 81, x^4, y^8*)*

(b) $\frac{x}{x-5}$ 3

$\frac{x(x-3)}{(x-5)(x-3)}$

B1 for x(x – 3)

B1 for (x – 5)(x – 3)

B1 cao

[5]

9. (a) (i) $27x^6y^3$ 4

B2 cao

(B1 for x^6y^3 *or* $27x^6$ *or* $27y^3$ *in a product)*

(ii) $\frac{t^6}{4}$

B2 cao

B1 for $\frac{1}{4}$ *in a product or* t^6 *in a product*

(B1 for $\frac{1}{(2t^{-3})^2}, \left(\frac{2}{t^3}\right)^{-2}$ *)*

(b) (i) $x^2 - 4x + 15$
$= (x - 2)^2 - 4 + 15$
$(x - 2)^2 + 11$
$p = -2$
$q = 11$ 3

M1 for sight of $(x - 2)^2$
A1 for $(x - 2)^2 - 4$ (+ 15)
A1 for $p = -2$ and $q = 11$

[7]

10. $\dfrac{\cancel{(5 + x)}(5 - x)}{5\cancel{(5 + x)}}$

$\dfrac{5 - x}{5}$ 3

B1 for $(5 + x)(5 - x)$
B1 for $5(5 + x)$
B1 cao for $\dfrac{5 - x}{5}$ oe

[3]

11. (a) (i) x^9 1

B1 cao

(ii) p^5 1

B1 cao

(iii) $12\,s^6\,t^5$ 2

B2 cao
(B1 for two of 12, s^6, t^5 in a product)

(iv) q^{12} 1

B1 cao

(b) $6g - 3$ 1

B1 cao

(c) $2d^2 + 6d$ 2

B2 cao (B1 for $2d^2$ or 6d)

(d) $x^2 + 3x + 2x + 6$ 2

$x^2 + 5x + 6$

B2 for $x^2 + 5x + 6$

(B1 for 3 out of 4 parts correct in working)

[10]

12. (a) $27x^6y^{12}$

$27x^6y^{12}$ 2

B2 for fully correct

B1 for 2 of 27, x^6, y^{12} correct in a 3 term product

(b) $6x^2 + 15x - 4x - 10$

$6x^2 + 11x - 10$ 2

B2 for fully correct

(B1 for 3 out of 4 terms correct in working including signs or 4 terms correct, incorrect signs)

(c) $\frac{(x+2)(x+3)}{x(x+2)}$

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

B2 for $\frac{x+3}{x}$

(B1 for x(x + 2) or (x + 2)(x + 3) seen)

[6]

13. (a) $x \times 3 - x \times 2x$

$= 3x - 2x^3$ 2

B2 cao

(B1 for a two term expression with either 3x or $2x^3$)

(b) $4x(3y + x)$ 2

M1 for taking out a factor of x, 2x, 2, 4 or 4x

A1 cao

(c) $\frac{5a}{b^2}$ 2

B2 for $\frac{5a}{b^2}$ *or* $5ab^{-2}$ *(accept* $\frac{5a}{1b^2}$*)*

(B1 for either dealing with the numbers or dealing with the powers of a)

(d) $\frac{\cancel{x-3}}{\cancel{(x+3)}\,(x+3)}$

$\frac{1}{x+3}$ 2

M1 for (x – 3)(x + 3)

A1 cao

[8]

14. (a) $x^2 - 4x + 3x - 12$

$= x^2 - x - 12$

$x^2 - x - 12$ 2

M1 for exactly 4 terms correct ignoring signs (x^2*, 4x, 3x, 12)*
or 3 out of 4 terms with correct signs (x^2*, –4x, +3x, –12)*
A1 cao

(b) $6x^2 - 8x + 15x - 20 = 6x^2 + 7x - 20$

$6x^2 + 7x - 20$ 2

M1 for exactly 4 terms correct ignoring signs ($6x^2$*, 8x, 15x, 20)*
or 3 out of 4 terms with correct signs ($6x^2$*, –8x, +15x, –20)*
A1 cao

(c) $(x + 2)(x + 5)$ 2

B2 cao
(B1 for exactly one of (x + 2), (x+ 5))

(d) $12p^8q^3$ 2

B2 cao
(B1 for any 2 out of 3 terms correct in a product
or 3 terms correct in a sum or part product)

(e) $6 = 15 + 4(q–5)$
$6 = 15 + 4q – 20$
$11 = 4q$
$= 2\frac{3}{4}$ 3

M1 for correct substitution of p and t.
M1 for correct expansion of 4(q – t) oe (eg 4q – 20, 4q – 4t)
A1 11/4 or 2 ¾ or 2.75
or
M1 for correct substitution of p and t.
M1 for $\frac{p-3t}{4} = q - t$ *oe*
A1 11/4 or 2 ¾ or 2.75

[11]

15. (a) $4y^{-2}$ OR $\frac{4}{y^2}$ 2

B2 cao
(B1 for $4y^n$*, where n is an integer OR* ay^{-2}*)*

(b) $6w^7x^3$ 2

B2 cao
(B1 for any 2 correct of 6, w^7*,* x^3*)*

[4]

16. (a) $x^2 – 2x – 24$ 2

$x^2 – 6x + 4x – 24$

M1 for any 3 terms correct
A1 cao

(b) $6x(2x – 3y)$ 2

B2 for 6x(2x – 3y)
(B1 for either x(12x – 18y) ***OR***
2x(6x – 9y) ***OR*** *3x(4x – 6y)*
OR *6x(ax – by) where either a ≠ 2 or b ≠ 3*

[4]

17. $\dfrac{x}{(2x+3)}$ 3

$\dfrac{x(2x-3)}{((2x-3)(2x+3))}$

B3 for $\dfrac{x}{(2x+3)}$

[B1 for x(2x + 3) seen

***AND** B1 for (2x − 3)(2x + 3) seen]*

[3]

18. $\dfrac{x^2}{x-5}$ 2

$\dfrac{x^2(5+x)}{(x+5)(x-5)}$

M1 for $\dfrac{x^2(5+x)}{(x+5)(x-5)}$

A1 cao

[2]

19. (a) k^3 1

B1 for k^3

(b) $7x - 1$ 2

$4x + 20 + 3x - 21$

*M1 for **three** of 4 terms 4x + 20 + 3x − 21 (or better)*

A1 for 7x − 1

[3]

20. (a) p^6 1

B1 cao

(b) w^{12} 1

B1 cao

(c) $5e^5f^3$ — 2

B2 cao
(B1 for either e^5 or f^3)

[4]

21. (a) x^{-5} — 3

B1 for x^{-5} or $\frac{1}{x^2}$

(b) $12w^8y^6$

B2 for w^8y^6
(B1 for any 2 of 12, w^8, y^6 correct)

[3]

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

$\frac{3}{2x-1}$ — 2

M1 for $(2x + 1)(2x – 1)$
A1 cao

[2]

23. (i) $12\,s^6\,t^5$

B2 cao
(B1 for two of 12, s^6, t^5 in a product)

(ii) q^{12}

B1 cao

[2]

24. $6x^2 - 4x + 15x - 10$
$6x^2 + 11x - 10$ 2

B2 for fully correct
(B1 for 3 out of 4 terms correct in working, including signs or 4 terms correct, incorrect signs)

[2]

25. $3x + 6 = 3(x + 2)$ 3
$x^2 - 4 = (x + 2)(x - 2)$
$\frac{3}{(x-2)}$

M1 for 3(x + 2)
M1 for (x + 2)(x – 2)
A1 cao

[3]

26. (a) $12ef$ 1

B1 cao

(b) $5(x + 3)$ 1

B1 cao

(c) $8r + 9$ 2

M1 for 2r + 6 + 6r + 3 ***or*** *8r* ***or*** *9*
A1 cao

[4]

27. $3x^2 + 3x - 5x - 5$ 2
$3x^2 - 2x - 5$

B2 cao
(B1 for 4 correct terms or 3 of 4 terms correct condoning incorrect signs)

[2]

28. $\dfrac{4}{x(x+3)} + \dfrac{5x}{x(x+3)}$ 2

$\dfrac{5x+4}{x(x+3)}$

M1 for $\dfrac{4}{x(x+3)} + \dfrac{5}{x(x+3)}$ *or*

4(x + 3) + 5x(x + 3) as numerator or
x(x + 3) or x(x + 3)(x + 3) as denominator

A1

[2]

29. (a) $2(4p - 3)$ 1

B1 cao

(b) $y^2(y - 1)$ 2

B2 for $y^2(y - 1)$ *or* $(y^2 + 0)(y - 1)$
(B1 for $y(y^2 - y)$ *or* $(y + 0)(y^2 - y)$*)*
SC: Award B1 for $y^2(y - 0)$ *or* $y^2(y + 1)$

(c) $e^2 + 7e + 12$ 2

M1 for 3 out of the 4 terms e^2, $4e$, $3e$, 12 *correct or* $e^2 + 7e + k$
A1 cao

[5]

30. $\dfrac{(x+2)(x+3)}{x+2}$ 3

$= x + 3$

M1 for attempting to factorise the quadratic by seeing
$(x \pm 2)(x \pm 3)$ *or* $(x \pm 6)(x \pm 1)$
A1 for $(x + 2)(x + 3)$
A1 cao (accept $\dfrac{x+3}{1}$*)*

[3]

31. $n^2 + 4n + 4 - (n^2 - 4n + 4)$ 2
$= n^2 + 4n + 4 - n^2 + 4n - 4$
$= 8n$

M1 for either $n^2 + 2n + 2n + 4$ or $n^2 - 2n - 2n + 4$ oe
A1 for showing that terms reduce to $8n$

[2]

32. (a) $15p - 6$ 1

B1 for $15p - 6$

(b) $6x + 3 + 6x - 2$
$= 12x + 1$ 2

B2 for $12x + 1$
(B1 for $12x$ or $+ 1$ or $6x + 3$ or $6x - 2$)

(c) $(a - 8)(a - 8)$ 2

B2 for $(a - 8)(a - 8)$ or $(a - 8)^2$
(B1 for a in both brackets and two numbers multiplying to 64 or –64)
Condone the missing trailing bracket.

33. $\dfrac{x^2 - 3}{x(x-2)}$ 2

M1 for common denominator $x(x - 2)$ oe
or common denominator $x(x - 2)(x - 2)$ oe
A1 for $\dfrac{x^2 - 3}{x(x-2)}$ or $\dfrac{x^2 - 3}{x^2 - 2x}$

[2]

34. $\dfrac{4(x-3)}{(x+5)(x-3)}+\dfrac{(x+5)}{(x+5)(x-3)}$ 4

$\dfrac{4(x-3)+(x+5)}{(x+5)(x-3)}$

$\dfrac{4x-12+x+5}{(x+5)(x-3)}$

$=\dfrac{5x-7}{(x+5)(x-3)}$

M1 for a denominator of (x + 5)(x – 3) common to ***two*** *fractions with the clear intention to add*

M1 for either $\dfrac{4(x-3)}{(x+5)(x-3)}$ *or* $\dfrac{(x+5)}{(x+5)(x-3)}$

M1 (dep on 2^nd M1) for $\dfrac{4(x-3)+(x+5)}{(x+5)(x-3)}$

A1 for $\dfrac{5x-7}{(x+5)(x-3)}$ ***or*** $\dfrac{5x-7}{x^2+2x-15}$

The first M1 (sum of ***two*** *fractions) could be implied by, for example:* $\dfrac{4+1}{(x+5)(x-3)}$

$\dfrac{5x-7}{(x+5)(x-3)}$ *is sometimes followed by various further attempts at simplification.*

If they are just trying to expand (x + 5)(x – 3) and make an error I am happy to ignore this subsequent working.

If however their attempts involve nonsensical algebra such as any arbitrary cancelling, then the final A1 will be lost.

[4]

35. $6x + 15 + 12x + 4$ 2

$= 18x + 19$

M1 for 6x + 15 or 12x + 4 seen

A1 for 18x + 19 oe (eg. 19 + 18x, 18 × x + 19)

[2]

36. $15x^2 - 3x + 20x - 4$ 2

	$3x$	4
$5x$	$15x^2$	$20x$
-1	$-3x$	-4

$15x^2 + 17x - 4$

B2 cao
(B1 for 4 correct terms with or without signs, or 3 out of no more than 4 terms, with correct signs. The terms may be in an expression or in a table, etc.)

M1 can be awarded for all 4 of $15x^2$, 20x, 3x and 4 seen irrespective of sign.
M1 can be awarded for any 3 of $15x^2$, 20x, –3x and –4 seen.
Note: 20x implies +20x

[2]

37. $\dfrac{4(a-5)}{(a+5)(a-5)}$ 3

$= \dfrac{4}{a+5}$

M1 for 4(a – 5)
M1 for (a + 5)(a – 5)
A1 cao

[3]

38. B

[1]

39. C

[1]

40. E

[1]

41. D

[1]

42. (a) $y^2 + 3y + 2y + 6$
$y^2 + 5y + 6$ 2

M1 for 3 terms out of y^2, $3y$, $2y$, 6
or $y^2 + 5y$ (+ c) or (dy^2 +)$5y + 6$
A1 for $y^2 + 5y + 6$

(b) $\dfrac{3(x-2)}{(x-2)(x-5)}$

$\dfrac{3}{x-5}$ 2

M1 for $(x \pm 2)(x \pm 5)$
A1 cao

[4]

43. E

[1]

1. **Mathematics A Paper 5**

Although the correct answer p^9 was often stated, a very common wrong answer was p^6. Candidates generally were less successful in part (ii). The common wrong approaches are indicated by these common wrong answers:
$\dfrac{6q^9}{q^3} = 6q^3$, or $3q \times 2q^2 = 6q^3$, or $\dfrac{5q^9}{q^3} = 5q^6$.

Mathematics B Paper 18

Part (i) was mostly answered correctly although p^6 was a frequently occurring incorrect answer. Part (ii) was successfully answered by a number of candidates although $5q^6$ was a commonly seen incorrect answer. Some candidates were able to proceed as far as $6q^9/q^3$ but then often gave a final incorrect answer of $6q^3$.

2. In part (a) most candidates gained credit for correctly obtaining at least 3 of the 4 terms but sign errors and numerical errors were seen far too frequently. In part (b) a significant number of candidates left x without any ‘power’. In part (c) those who used the difference of two squares were generally successful but, for many, this became a question where ‘everything’ cancelled.

3. Part (a) was a routine factorisation, but proved to be too hard for many candidates.
Those who could do part (a) generally went on in part (b) to complete the correct cancellation of the algebraic fraction following the factorisation of the numerator.

4. Only about one quarter of the candidates factorised $x^2 - 3x$ correctly in part (a). Many candidates did not seem to know what was required and few of those not gaining both marks recognised that x was a common factor. Candidates were more successful in part (b) but there were a surprising number who did not know what to do and both $k3$ and $k^{2.5}$ were common incorrect answers. In part (c) many candidates correctly expanded the brackets in (i) to produce three or four correct terms but the resulting expression was often simplified incorrectly. A common mistake was for +20 –21 to become +41. Fewer correct answers were seen in (ii) and a common incorrect answer to this part was $2x+5y$. Many of the candidates who knew what to do obtained three correct terms and gave the fourth term as $6y$ or $5y^2$. When three or four terms were obtained there was a good success rate with collecting like terms. Correct answers to part (d) were extremely rare. Some of those who appeared to know how to factorise the expression failed to use brackets correctly and wrote $p + q(p + q +5)$.

5. **Mathematics A**

Part (a) is notionally grade B and many candidates were able to make a beginning. However, there were many poor attempts with common errors being $120 - 3x = 12 + 3x$ and $40 - x = 12 + 3x$, so, $28 = 2x$.
Part (b) was poorly answered with most candidates not spotting the factorisation of the denominator. Many cancelled the $4x^2$ only.

Mathematics B

Paper 17

This was very poorly answered with candidates, again, preferring to employ trial and improvement methods (which nearly always failed). Algebraic techniques were often abandoned after numerous errors would lead to unlikely solutions.
Of those candidates who understood the algebraic methods many often multiplied the equations by appropriate scale factors and then either added or subtracted their equations inaccurately.

Paper 19

Fully correct solutions were seen by about half the candidates. The majority of candidates were aware of the basic method to use to solve this question but failed to carry it out successfully. The most common error was to carry out the wrong operation at the substitution stage. Of those candidates who chose the correct operation at this stage, poor arithmetic prevented them from obtaining the correct solution.

6. Good candidates recognised that they had to factorise the numerator and factorise the denominator and then to cancel any common factors. Many candidates did not see this and cancelled individual terms. Many others could not factorise at least one of the numerator and denominator.

7. This was a set of standard algebraic simplifications. Part (a) caused no problems but weaker candidates on part (b) made errors such as adding the 3 and the 5 to get $8x^3y4$, or treating the power of the x as zero rather than 1. On part (c) many candidates expanded the numerator and then candled the x terms.
Part (d), difference of two squares was recognised as such by many. Other attempts, however, rarely resulted in a correct answer with such as $(a – 9b)^2$, $a(a – 9b)$ and $(a – 3b)^2$often seen.

8. It was a standard evaluation. Several candidates sensibly wrote out $3xy^2$ four times and then multiplied the terms together. Common errors included a coefficient of 12 or a term in x of just x alone. Some candidates did not evaluate 3^4.
On part (b) those candidates who factorised the numerator and denominator were usually given all three marks. Many candidates scored zero marks, usually by cancelling the squared terms and the x terms to give for example $\frac{1}{5x+15}$.

9. Part (a)(i) was a standard simplification and many candidates scored 1 or both marks. A common error was $3^3 = 9$, with another being $(x^2)^3=x^5$
Part (a)(ii) proved to be more demanding because of the negative powers and few candidates scored both marks. The most straightforward approach of $\left(2t^{-3}\right)^2 = 2^{-2}t^6$ was rarely seen. Most candidates tried to invert the terms and often failed to do so correctly.
Part (b) was fairly well answered reflecting on the degree to which candidates have been successfully trained to answer such questions. A minority of otherwise successful candidates wrote p = 2 rather than the correct $p = – 2$

10. Although many weak candidates were unable to make much progress with this question, most strong candidates gained at least one mark, usually for factorising $25 + 5x$. A common error in factorising $25 – x^2$ was$(x – 5)(x + 5)$. A common error amongst weaker candidates was
$$\frac{25-x^2}{25+5x}=\frac{-x^2}{5x}$$

11. This was a question which tested basic algebraic techniques and as such was answered very well by the vast majority of candidates. In 6(a) parts (i) and (ii) were very well answered. The most common error on part (i ii) was to add the 4 and 3 to give an answer of $7s^6t^5$. Part (iv) was also well answered, although incorrect attempts such as q^7or $4q^{12}$ were often seen.
Part (b) was very well answered, as was part (c).
Part (d) was well answered, with only a very few students unable to access the question.

12. All 3 parts were straightforward tests of algebraic manipulation. All parts were answered correctly by many candidates. In part (a) the main error was with the 3 where answers of $3x^6y^{12}$ and $9x^6y^{12}$ were common. On part (c) some candidates simplified correctly to $\frac{x+3}{x}$ but then went on to 'simplify' to 3.

13. Part (a) was done well. Most candidates were able to obtain the $3x$ term, but errors in obtaining the $2x^3$ term were frequent- typically this term was written as $3x$, $3x^2$, $2x^2$ or $6x^2$. Some candidates knew the method for expanding brackets but were unable to complete the algebra, thus leaving their final answer as $x \times 3 - x \times 2x^2$

A small number of candidates expanded the brackets correctly but then went on to 'simplify' their expression further. Common incorrect final answers here were x^2, $-x^2$, x^3, $-x^3$, $1x^{-2}$

Most candidates were able to score at least 1 mark in part (b). The requirement to use brackets was understood and if not fully factorised many were able to extract at least one common factor, usually $4(3xy + x^2)$ or $x(12y + 4x)$.

Those candidates that chose to show their working in part (c) were often able to gain a mark for either simplifying the numbers or simplifying the terms in a, but many candidates went straight to the answer, typically writing $5ab^2$. Another popular error was to cancel the square from the a with the square from the b, i.e. going from $5a^2/ab^2$ to $5a/ab$. A significant number of candidates showed separately that $20/5 = 4$ and $a^2/a = a$ but then wrote their final answer as $5ab^2$

In part (d), only the best candidates were able to score full marks on this question. A surprising number of candidates, having correctly factorised the denominator and correctly cancelled the common factor from both, the numerator and the denominator, and then went on to give their final answer as $x + 3$. By far the most common method was to cancel like terms from both the numerator and the denominator to achieve variations of $\frac{\cancel{x}-\cancel{3}}{x^2-\cancel{9}^3} = \frac{1}{x-3}$

14. Parts (a) to (d) were straightforward tests of algebraic manipulation. Generally, these were carried out well, with few errors. There were some difficulties with part (d) with answers such as pq($3p^4 \times 5p^2q$), $7p^8q^3$ and $12p^8 + q^3$.

Part (e) proved more of a challenge for weaker candidates. There are essentially two approaches; the first approach involves rearranging the algebra to $q = \frac{p - 3t + 4t}{4}$ and then substituting for p and t. This gives the value of q directly. The second approach is to substitute for p and t first and then to solve the resulting equation. The second approach proved to be more popular and was generally successful. However, many candidates made a BIDMAS error of $6 = 15 + 4(q - 5) \Rightarrow 6 = 19(q - 5)$.

15. $9y^{-2}$ was a popular incorrect answer in (a), as was $5w^7x^3$ in (b). In (a) the answer was often given incorrectly as $\frac{1}{4y^2}$

16. This question was not well answered. A number of candidates scored 1 mark in part (a) for 3 correct terms only, usually giving the numerical term as –2 or + 24. Mistakes at the simplification stage were commonplace where candidates combined terms that should have been separate. The requirements of factorisation is not understood by many candidates as part (b) was seldom done correctly. This part was very centre dependant and even then partial factorisation, earning 1 mark, was seen more than the complete answer.

17. This was a demanding question, which enabled the most able candidates to display good algebraic techniques. Some candidates were able to factorise the numerator but not the denominator. The majority of candidates tried various forms of cancelling (typically starting with the squared terms) without factorising.

18. Candidates who were able to factorise the denominator usually went on to gain full marks although there were a significant number of such candidates who lost the accuracy mark as they then incorrectly simplified $\frac{x^2}{x-5}$ as $\frac{x}{-5}$.

19. 57% gained the mark in part (a). In part (b) the expansion of brackets was accurately done by over 60% of the candidates (condoning one error); however $4x + 20 + 3x - 21$ often led to $7x + 41$, $7x - 41$, $x - 1$, $x + 1$ or $7x + 1$ only one third correctly simplifying to $7x - 1$.

20. Part (a) was answered correctly by 85% of candidates. Fewer candidates were successful in answering part (b) correctly with w^{64} and w^7 being popular incorrect answers. Approximately 90% of candidates were able to gain some credit in (c). The common error was to give f^2 instead of f^3 in the answer.

21. Approximately 70% of candidates were able to give correct solutions to both parts if this question. The common error in (a) was to give the answer as x^5 instead of x^{-5}. In part (b), candidates frequently added the integer parts of the expressions of made an error in one of the powers.

22. Only a very small minority of candidates realised that $4x^2 - 1$ could be factorised. Those candidates who did factorise the denominator correctly were generally able to go on score full marks. Other candidates were unable to make any progress and plenty of incorrect cancelling was seen.

23. In part (i) $7s^6t^5$ and $12s^8t^6$ were the most common incorrect answers and in part (ii) q^7 was seen many times.

24. This question was answered correctly by approximately 60% of candidates. The most common error when expanding the brackets was to give $2x \times 3x$ as $6x$ rather than $6x^2$. There were some errors in arithmetic seen after a correct expansion with $-4x + 15x$ simplified to $-19x$ rather than $-11x$ being the most common.

25. Only 16% of candidates were able to get a fully correct solution to this question and quite well done by those who attempted a factorisation. More got the numerator correct than did the denominator, the latter often recognised as the difference between 2 squares but with 4's instead of 2's. However a popular way was to cancel terms on the top with those on the bottom without factorising at all. So $6 - 4$ became 2 giving $3x + 2$ which had to be watched out for! The x's were often cancelled and of the other combinations…$9x$ / 4was quite popular.

26. This question was very well understood with 80% achieving success with part (a) 65% with the factorising in part (b) and 60% getting part (c) fully correct with a further 20% gaining partial success for $8r$ or 9

27. This question well understood with 60% of candidates able to gain at least one mark for partial expansion of the two brackets and 40% able to fully expand and simplify their answer.

28. This was a very poorly answered question. Candidates found simplifying algebraic fractions very difficult. Only 20% of candidates could make an attempt at finding a common denominator let alone the lowest common denominator with only 5% able to achieve a single correct fraction. $9/x$ was very popular as was the denominator $x^2 + 4x + 3$. It is a shame when able candidates get the correct answer and then spoil it by 'cancelling' more x's inappropriately. More candidates got the denominator correct than the numerator.

29. Factorising '$8p - 6$' in part (a) provided a reasonable introduction to this algebra question with just over half the candidates writing correct responses. Less confident attempts might have been helped by breaking down the expression into component parts like '$(4)(2)p - (3)(2)$' which allows the '2' to be seen as the common factor.

Part (b) was rather more troublesome with many gaining just part marks for writing '$y(y^2 - y)$' instead of the full factorisation leading to '$y^2(y - 1)$'. It was not unusual to find that further simplification was attempted turning a correct final answer into one that was incorrect. It is important that candidates know when to stop in algebra questions as subsequent working is taken into account when assessing the award of marks. The mean mark of 0.52 for this question may well have been higher as a result.

Part (c) required the expansion of two brackets by multiplication. It was encouraging to find that a method was being applied to successfully achieve the multiplication of the brackets. Less impressive was the number of numerical errors being made with '$4 \times 3 = 7$' high on the list. It was disappointing to find once more that, having arrived at the correct expression of '$e^2 = 7e + 12$', there was the desire to combine terms together and thus forfeit the answer mark. The mean mark for this part of the question was 1.17.

30. The simplifying of the algebraic expression was quite testing for many. The usual trick of attempting to cancel out individual terms from the numerator and denominator was much in evidence. For example the '6' was cancelled down by the '2' leaving a bare figure of '3' and a similar process was applied to the 'x' terms. There was, however, a significant number who realised that the numerator had to be factorised first. The factorisation though was not handled confidently with abandoned brackets littering the working space.

For the few who managed to achieve the expression $\frac{(x+2)(x+3)}{x+2}$ they did not always continue to simplify further and thus lost the mark for the final answer.

31. A variety of methods were used in this question, some of which were more convincing than others. Many tried to prove the result using a numerical method which was really no more than substituting values into the left hand side to show that it did indeed produce the right hand side. Since it worked for one or two or three values they erroneously concluded that it must work for all values. This being very clearly an algebra question any numerical approach was not rewarded. For those who approached it algebraically, errors in expanding the brackets '$(n + 2)^2$' and '$(n - 2)^2$' did not help. A further difficulty arose in dealing with the negative sign between the two brackets as those who disregarded it managed to simplify the left hand side to '8' rather than '$8n$'. In spite of this there were some very elegant solutions, from a minority, who set out their solution in a developing way to show the stages in achieving a proof. Most clearly struggled with this type of question with the mean mark being only 0.13 even though a mark could have been scored merely by expanding one of the brackets correctly.

32. ¾ of the candidates were able to expand $3(5p - 2)$ correctly in part (a). In part (b) most candidates scored at least one of the two available marks by either expanding one of the brackets correctly, (generally the first), or correctly adding each of the $6x$ terms from their attempt at the expansion of the two brackets. The mean mark for this part of the question was 1.17.

The mean mark of 0.57 in (c) indicates that not many of the candidates were able to factorise $a^2 - 16a + 64$ correctly. Many candidates did, however, manage to score 1 of the 2 available marks by getting the correct expressions in each of the brackets but getting one or both of the signs incorrect. A few scored 1 mark for a in both brackets with two numbers whose product was 64 or −64.

33. Candidates found it very difficult to write the given fractions as a single fraction. The few who were able to score 1 mark for having a common denominator, even if it was not the simplest one, were then at a loss as to how to proceed. It was not uncommon to see the x terms being cancelled. The mean mark for the question was 0.21.

34. This question was very poorly answered indeed, many candidates having no idea how to add two algebraic fractions.

For some of the more able candidates, marks were often lost through poor algebraic manipulation, but most often it was in giving an answer as $\frac{5}{(x+5)(x-3)}$ This answer did gain one mark for a correct common denominator. Many candidates made errors in the expansion of the denominator, but this was not penalised if it was clear what they were trying to expand. Some tried to "cross multiply" with the additional complication of adding the denominators.

The accuracy mark was often lost for cancelling what would have been the correct addition.

35. Although the correct answer of $18x + 19$ was the modal response, it was disappointing to see many candidates struggle with this question. The expansion of each of the brackets was often poor with answers of $6x + 5$ and $12x + 1$ common. In adding together $6x$ and $12x$, many gave $18x^2$ as their answer. A significant number of candidates followed their attempts at expanding each of the brackets by then finding the product of their expansions.

Weaker candidates expanded the brackets as $3 \times 7x$ and $4 \times 4x$ to give an answer of $37x$ $(21x + 16x)$

36. This expansion was not done well, particularly when finding the product of $3x$ and $5x$; $15x$ being the most common answer. An answer of $32x - 4$ was therefore not uncommon. Careless errors with signs prevented many candidates gaining full marks.

Weaker candidates, of which there was much evidence, gave $7x + 4$ or similar as their answer, as a result of trying to add the brackets.

37. Very few candidates attempted to factorise both the numerator and the denominator Some, who did, then spoiled it by incorrect cancelling, but more often this did usually gave a fully correct solution.

More often, candidates made attempts at simply cancelling the given expressions, for example; $\dfrac{4a-20^4}{a^2-25^5}$ to give $\dfrac{4}{a-5}$ or similar, gaining no marks.

38. No Report available for this question.

39. No Report available for this question.

40. No Report available for this question.

41. No Report available for this question.

42. A variety of methods were used by candidates when answering the first part of the question. Almost 80% of answers seen gained at least one mark for writing down 3 or more correct terms in the expansion. A common error from those who did not score full marks for this part of the question was to add rather than multiply the constant terms. In part (b) partial credit was given to candidates who made a good attempt at factorising the denominator of the fraction. Some candidates multiplied out the numerator and tried to factorise the denominator (sometimes successfully) and hence failed to simplify the fraction. Clearly, for some candidates this material was unfamiliar territory. About one quarter of candidates completed this part successfully.

43. No Report available for this question.