

A Algebraic Fractions: Multiplying/Dividing and Quadratics

19 Write as a single fraction in its simplest form.

(a) $\frac{5a}{6} \times \frac{3b}{a}$

$$\frac{\cancel{5}^1 \cancel{a}^1}{\cancel{6}_2} \times \frac{\cancel{3}^1 \cancel{b}^1}{\cancel{a}^1} = \frac{5b}{2}$$

$$\frac{5b}{2}$$

[2]

10 Simplify.

$\frac{p}{2q} \times \frac{4pq}{t}$

$$\frac{\cancel{p}^1}{\cancel{2q}_2} \times \frac{\cancel{4}^2 \cancel{p}^1 \cancel{q}^1}{t} = \frac{2p^2}{t}$$

$$\frac{2p^2}{t}$$

[2]

3 Simplify fully.

$\frac{5x}{12} \times \frac{4}{15x}$

$$\frac{\cancel{5x}^1}{\cancel{12}_3} \times \frac{\cancel{4}^1}{\cancel{15x}_3} = \frac{5}{45} = \frac{1}{9}$$

$$\frac{1}{9}$$

[2]

(b) Simplify $\frac{a}{x} \div \frac{b}{2y}$.

Give your answer as a single fraction.

$$\frac{a}{x} \times \frac{2y}{b} = \frac{2ay}{bx}$$

$$\frac{2ay}{bx}$$

[1]

15 Simplify.

$$\frac{x-4}{x^2-16}$$

$$\frac{x-4}{(x+4)(x-4)} \quad \begin{array}{l} \div (x-4) \\ \div (x-4) \end{array}$$

$$= \frac{1}{x+4}$$

$$\frac{1}{x+4} \dots\dots\dots [2]$$

(b) Simplify.

$$\frac{x-5}{x^2-25}$$

$$\frac{x-5}{(x+5)(x-5)} \quad \begin{array}{l} \div (x-5) \\ \div (x-5) \end{array}$$

$$= \frac{1}{x+5}$$

$$\frac{1}{x+5} \dots\dots\dots [2]$$

23 Simplify.

$$\frac{2x^2+10x}{x^2-25}$$

$$\frac{2x(x+5)}{(x+5)(x-5)} \quad \begin{array}{l} \div (x+5) \\ \div (x+5) \end{array}$$

$$= \frac{2x}{x-5}$$

$$\frac{2x}{x-5} \dots\dots\dots [3]$$

19 Simplify.

$$\frac{7x-x^2}{49-x^2}$$

$$\frac{x(7-x)}{(7+x)(7-x)}$$

$$= \frac{x}{7+x}$$

$$\frac{x}{7+x} \dots \dots \dots [3]$$

22 Simplify.

$$\frac{5x-x^2}{25-x^2}$$

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

$$= \frac{x}{5+x}$$

$$\frac{x}{5+x} \dots \dots \dots [3]$$

16 Simplify $\frac{x^2y-3xy}{x^2-2x-3}$

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

$$= \frac{xy}{x+1}$$

$$\frac{xy}{x+1} \dots \dots \dots [3]$$

22 Simplify.

$$\frac{x^2 - 5x}{2x^2 - 50}$$

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

$$= \frac{x(\cancel{x-5})}{2(x+5)(\cancel{x-5})}$$

$$= \frac{x}{2(x+5)}$$

$$\frac{x}{2(x+5)} \dots\dots\dots [4]$$

21 Simplify.

$$\frac{5p^2 - 20p}{2p^2 - 32}$$

$$\frac{5p(p-4)}{2(p^2-16)}$$

$$= \frac{5p(\cancel{p-4})}{2(p+4)(\cancel{p-4})}$$

$$= \frac{5p}{2(p+4)}$$

$$\frac{5p}{2(p+4)} \dots\dots\dots [3]$$

20 Write as a single fraction in its simplest form.

(a) $\frac{10x^2 - 60x}{x^2 - x - 30}$

$$\frac{10x(\cancel{x-6})}{(\cancel{x-6})(x+5)}$$

$$= \frac{10x}{x+5}$$

$$\frac{10x}{x+5} \dots\dots\dots [3]$$

7 (a) Simplify.

$$\frac{x^2 - 25}{x^2 - x - 20}$$

$$\frac{(x+5)(\cancel{x-5})}{(\cancel{x-5})(x+4)}$$

$$= \frac{x+5}{x+4}$$

$$\frac{x+5}{x+4} \dots\dots\dots [3]$$

24 Simplify.

$$\frac{x^2 - 25}{x^2 - 17x + 60}$$

$$\frac{(x+5)(\cancel{x-5})}{(x-12)(\cancel{x-5})}$$

$$= \frac{x+5}{x-12}$$

$$\frac{x+5}{x-12} \dots\dots\dots [4]$$

18 Simplify.

$$\frac{w^2 - 9}{2w^2 + 5w - 3}$$

$$2w^2 + 5w - 3$$

$$ac = -6$$

two numbers: 6, -1

$$\rightarrow 2w^2 + 6w - w - 3$$

$$2w(w + 3) - 1(w - 3)$$

$$(2w - 1)(w + 3)$$

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

$$= \frac{w-3}{2w-1}$$

$$\frac{w-3}{2w-1}$$

$$\dots\dots\dots [4]$$

23 Simplify.

$$\frac{5x^2 - 19x + 12}{x^2 - 9}$$

$$5x^2 - 19x + 12$$

$$ac = 60$$

two numbers: -15, -4

$$\rightarrow 5x^2 - 15x - 4x + 12$$

$$5x(x - 3) - 4(x - 3)$$

$$(5x - 4)(x - 3)$$

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

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

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

$$\dots\dots\dots [4]$$

21 Simplify.

$$\frac{2x^2 + 5x - 12}{4x^2 - 9}$$

$$2x^2 + 5x - 12$$

$$ac = -24$$

two numbers: 8, -3

$$\rightarrow 2x^2 + 8x - 3x - 12$$

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

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

$$\frac{(2x-3)(x+4)}{(2x+3)(2x-3)}$$

$$(2x+3)(2x-3)$$

$$= \frac{x+4}{2x+3}$$

$$\frac{x+4}{2x+3}$$

[4]

22 Simplify.

$$\frac{2x^2 - 5x - 12}{3x^2 - 12x}$$

$$2x^2 - 5x - 12$$

$$ac = -24$$

two numbers: -8, 3

$$\rightarrow 2x^2 - 8x + 3x - 12$$

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

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

$$\frac{(2x+3)(x-4)}{3x(x-4)}$$

$$3x(x-4)$$

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

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

[4]

(b) Write as a single fraction in its simplest form.

$$\frac{4}{2x-3} \div \frac{2x^2+14x}{2x^2+11x-21}$$

$$2x^2 + 11x - 21$$

$$ac = -42$$

two numbers: 14, -3

$$\rightarrow 2x^2 + 14x - 3x - 21$$

$$2x(x+7) - 3(x+7)$$

$$(2x-3)(x+7)$$

$$\frac{4}{2x-3} \div \frac{2x(x+7)}{(2x-3)(x+7)}$$

$$= \frac{4}{2x-3} \div \frac{2x}{2x-3}$$

$$= \frac{4}{\cancel{2x-3}} \times \frac{\cancel{2x-3}}{2x}$$

$$= \frac{4}{2x}$$

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

$$\frac{2}{x}$$

[4]

(b) (i) Factorise.

$$x^2 - 9$$

$$(x+3)(x-3)$$

$$\dots\dots\dots (x+3)(x-3) \dots\dots\dots [1]$$

(ii) Simplify.

$$\frac{x^2 - 9}{2xy - 6y + 5x - 15}$$

$$\begin{aligned} 2xy - 6y + 5x - 15 \\ 2y(x-3) + 5(x-3) \\ (2y+5)(x-3) \end{aligned}$$

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

$$\frac{x+3}{2y+5}$$

$$\dots\dots\dots [3]$$

11 Simplify.

$$\frac{ax^2 + 5ax + bx + 5b}{x^2 - 25}$$

$$\begin{aligned} ax^2 + 5ax + bx + 5b \\ ax(x+5) + b(x+5) \\ (ax+b)(x+5) \end{aligned}$$

$$\frac{(ax+b)\cancel{(x+5)}}{(x+5)\cancel{(x-5)}}$$

$$\frac{ax+b}{x-5}$$

$$\dots\dots\dots [3]$$

24 Simplify.

$$\frac{ax - 2a - x + 2}{a^2 - 1}$$

$$ax - 2a - x + 2$$

$$a(x - 2) - 1(x - 2)$$

$$(a - 1)(x - 2)$$

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

$$\frac{x-2}{a+1}$$

[4]

23 Simplify.

$$\frac{3xy + 36y - 5x - 60}{2x^2 - 288}$$

$$3xy + 36y - 5x - 60$$

$$3y(x + 12) - 5(x + 12)$$

$$(3y - 5)(x + 12)$$

$$\frac{(3y-5)(x+12)}{2(x^2-144)}$$

$$= \frac{(3y-5)(x+12)}{2(x-12)(x+12)}$$

$$\frac{3y-5}{2(x-12)}$$

[4]

17 Simplify.

$$\frac{3x - 6y - ax + 2ay}{x^3 - 2x^2y}$$

$$\begin{aligned} 3x - 6y - ax + 2ay \\ 3(x - 2y) - a(x - 2y) \\ (3 - a)(x - 2y) \end{aligned}$$

$$\begin{aligned} \frac{(3-a)(x-2y)}{x^2(x-2y)} \\ = \frac{3-a}{x^2} \end{aligned}$$

$$\frac{3-a}{x^2}$$

[4]

26 Simplify.

$$\frac{ux - 2u - x + 2}{u^2 - 1}$$

$$\begin{aligned} ux - 2u - x + 2 \\ u(x - 2) - 1(x - 2) \\ (u - 1)(x - 2) \end{aligned}$$

$$\begin{aligned} \frac{(u-1)(x-2)}{(u-1)(u+1)} \\ = \frac{x-2}{u+1} \end{aligned}$$

$$\frac{x-2}{u+1}$$

[4]

15 Simplify.

$$\frac{3-a}{3p-6t-ap+2at}$$

$$\begin{aligned} 3p - 6t - ap + 2at \\ 3(p - 2t) - a(p - 2t) \\ (3-a)(p-2t) \end{aligned}$$

$$\begin{aligned} & \frac{\cancel{3-a}}{\cancel{(3-a)}(p-2t)} \\ &= \frac{1}{p-2t} \end{aligned}$$

$$\frac{1}{p-2t} \dots\dots\dots [3]$$

(d) Simplify.

$$\frac{2x-1-4ax+2a}{2x^2-x}$$

$$\begin{aligned} 2x - 1 - 4ax + 2a \\ 1(2x-1) - 2a(2x-1) \\ (1-2a)(2x-1) \end{aligned}$$

$$\begin{aligned} & \frac{(1-2a)\cancel{(2x-1)}}{x\cancel{(2x-1)}} \\ &= \frac{1-2a}{x} \end{aligned}$$

$$\frac{1-2a}{x} \dots\dots\dots [4]$$

25 Simplify.

$$\frac{2x^2 + x - 15}{ax + 3a - 2bx - 6b}$$

$$2x^2 + x - 15$$

$$ac = -30$$

two numbers: 6, -5

$$\begin{aligned} \rightarrow 2x^2 + 6x - 5x - 15 \\ 2x(x+3) - 5(x+3) \\ (2x-5)(x+3) \end{aligned}$$

$$ax + 3a - 2bx - 6b$$

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

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

$$\rightarrow \frac{(2x-5)(x+3)}{(a-2b)(x+3)}$$

$$= \frac{2x-5}{a-2b}$$

$$\frac{2x-5}{a-2b}$$

[5]

(b) $\frac{6x^2 + x - 12}{6ax - 8a - 3x + 4}$

$$6x^2 + x - 12$$

$$ac = -72$$

two numbers: 9, -8

$$\begin{aligned} \rightarrow 6x^2 + 9x - 8x - 12 \\ 3x(2x+3) - 4(2x+3) \\ (3x-4)(2x+3) \end{aligned}$$

$$6ax - 8a - 3x + 4$$

$$2a(3x-4) - 1(3x-4)$$

$$(2a-1)(3x-4)$$

$$\rightarrow \frac{(3x-4)(2x+3)}{(2a-1)(3x-4)}$$

$$= \frac{2x+3}{2a-1}$$

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

[5]