Past Papers

Factorization

PAST PAPERS/2020/O-N/P-12/Q 3

3 Factorise.

(a) $12t^2 - 4t$

$\mathbf{12t^2 - 4t}$

$\mathbf{4t(3t - 1)}$

(b) $a(x-y) + b(y-x)$

$\mathbf{a(x - y) - b(x - y)}$

$\mathbf{(x - y)\,(a - b)}$

(c) $x^2 - 2x - 3$

$\mathbf{x^2 - 3x + x - 3}$

$\mathbf{x(x - 3) + 1(x - 3)}$

$\mathbf{(x - 3)\,(x + 1)}$

PAST PAPERS/2020/O-N/P-12/Q 3

9 **(a)** Simplify $3(3a-4)+2(2-a)$.

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

$9a-12+4-2a$

$9a-2a+4-12$

$7a-8$

PAST PAPERS/2020/M-J/P-12/Q 7

Factorise $15a-5x-2xy+6ay$.

$$15a - 5x + 6ay - 2xy$$

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

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

PAST PAPERS/2019/O-N/P-12/Q 5

5 Factorise.

(a) $49 - 9t^2$

$\mathbf{49 - 9t^2}$

$\mathbf{(7)^2 - (3t)^2}$

$\mathbf{(7 + 3t)(7 - 3t)}$

(b) $15xy + 5x - 6y - 2$

$\mathbf{15xy + 5x - 6y - 2}$

$\mathbf{5x(3y - 1) - 2(3y - 1)}$

$\mathbf{(3y - 1)(5x - 2)}$

PAST PAPERS/2019/O-N/P-22/Q 6

6 **(d)** Solve $5(x+3) = 2x(2x-1)$.
Show your working.

$$\mathbf{5(x+3) = 2x(2x-1)}$$

$$\mathbf{5x + 15 = 4x^2 - 2x}$$

$$\mathbf{0 = 4x^2 - 2x - 5x - 15}$$

$$4x^2 - 7x - 15 = 0$$

$$\mathbf{4x^2 - 12x + 5x - 15 = 0}$$

$$\mathbf{4x(x-3) + 5(x-3) = 0}$$

$$\mathbf{(x-3)\ (4x+5) = 0}$$

$$\mathbf{x - 3 = 0} \qquad \mathbf{4x + 5 = 0}$$

$$\mathbf{x = 3} \qquad \mathbf{x = -\frac{5}{4}}$$

PAST PAPERS/2019/M-J/P-12/Q 13

(a) Expand and simplify $(x-3)^2$.

$(x-3)^2$

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

$x^2 - 6x + 9$

(b) Factorise $18-6y+5xy-15x$.

$18 - 6y + 5xy - 15x$

$18 - 6y - 15x + 5xy$

$6(3 - y) - 5x(3 - y)$

$(3 - y)(6 - 5x)$

PAST PAPERS/2019/M-J/P-12/Q 14

(a) Write x^2-7x+5 in the form $(x-a)^2-b$.

$$x^2-7x+5$$

$$(x^2)-(7x)+\left(\frac{7}{2}\right)^2+5-\left(\frac{7}{2}\right)^2$$

$$\left(x^2-7x+\left(\frac{7}{2}\right)^2\right)-5+\frac{49}{4}$$

$$\left(x-\frac{7}{2}\right)^2-\frac{9}{4}$$

(b) Hence write down the minimum value of x^2-7x+5.

$$-\frac{9}{4}$$

PAST PAPERS/2018/O-N/P-12/Q 5

(a) Simplify $4c - 3(2c - 5)$.

$$4c - 3(2c - 5)$$

$$4c - 6c + 15$$

$$-2c + 15$$

$$15 - 2c$$

(b) Factorise $8 - 10y + 12x - 15xy$.

$$8 - 10y + 12x - 15xy$$

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

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

PAST PAPERS/2018/M-J/P-12/Q 5

(a) Factorise $25t^2 - 4$.

$25t^2 - 4$

$(5t)^2 - (2)^2$

$(5t + 2)(5t - 2)$

(b) Factorise $x^2 - 6x - 3xy + 18y$.

$x^2 - 6x - 3xy + 18y$

$x(x - 6) - 3y(x - 6)$

$(x - 6)(x - 3y)$

PAST PAPERS/2017/O-N/P-12/Q 22

(a) Factorise $9a^2 - 6a$.

$9a^2 - 6a$

$3a(3a - 2)$

(b) Factorise $4 - 25t^2$.

$4 - 25t^2$

$(2)^2 - (5t)^2$

$(2 + 5t)(2 - 5t)$

(c) Factorise $6cd - xy + 2cx - 3dy$.

$6cd - xy + 2cx - 3dy$

$6cd - 3dy + 2cx - xy$

$3d(2c - y) + x(2c - y)$

$(2c - y)(3d + x)$

PAST PAPERS/2017/O-N/P-22/Q 5

(b) Solve $2x(x+1) = 3(4-x)$.

$$2x^2 + 2x = 12 - 3x$$

$$2x^2 + 2x + 3x - 12 = 0$$

$$2x^2 + 5x - 12 = 0$$

$$2x^2 + 8x - 3x - 12 = 0$$

$$2x(x+4) - 3(x+4) = 0$$

$$(x+4)(2x-3) = 0$$

$$x + 4 = 0 \quad , \quad 2x - 3 = 0$$

$$x = -4 \quad , \quad 2x = 3$$

$$x = -4 \quad , \quad x = \frac{3}{2}$$

PAST PAPERS/2017/M-J/P-22/Q 5

(b) Simplify $4(3x-2y+1)-(5x-3y+1)$.

$$\mathbf{4(3x-2y+1)-(5x-3y+1)}$$

$$\mathbf{12x-8y+4-5x+3y-1}$$

$$\mathbf{12x-5x-8y+3y+4-1}$$

$$\mathbf{7x-5y+3}$$

(c) Factorise $9m^2 - 4n^2$.

$$\mathbf{9m^2 - 4n^2}$$

$$\mathbf{(3m)^2 - (2n)^2}$$

$$\mathbf{(3m + 2n)(3m - 2n)}$$

(d) Factorise $q(p-2) + 3(2-p)$.

$$\mathbf{q(p-2) + 3(2-p)}$$

$$\mathbf{q(p-2) - 3(p-2)}$$

$$\mathbf{(p-2)(q-3)}$$

PAST PAPERS/2016/O-N/P-22/Q 2

(e) (i) Find the two solutions of $5x - 1 = \pm 9$.

$5x - 1 = \pm 9$

$5x - 1 = 9$, $5x - 1 = -9$

$5x = 9 + 1$, $5x = -9 + 1$

$5x = 10$, $5x = -8$

$5x = 10$, $5x = -8$

$x = \frac{10}{5}$, $x = -\frac{8}{5}$

$x = 2$, $x = -1.6$

PAST PAPERS/2016/M-J/P-22/Q 5

(a) Factorise fully $8x^2y - 12x^5$.

$$\mathbf{8x^2y - 12x^5}$$

$$\mathbf{4x^2(2y - 3x^3)}$$

PAST PAPERS/2015/O-N/P-12/Q 16

(a) Factorise

(i) $4p^2 - 9q^2$,

$(2p)^2 - (3q)^2$

$(2p + 3q)(2p - 3q)$

(ii) $2n^2 + 5n - 3$.

$2n^2 + 5n - 3$

$2n^2 + 6n - 1n - 3$

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

$(n + 3)\ (2n - 1)$

(c) Factorise $6x - 3yt + 18y - xt$.

$$6x - 3yt + 18y - xt$$

$$6x - xt + 18y - 3yt$$

$$x(6 - t) + 3y(6 - t)$$

$$(6 - t)(x + 3y)$$

PAST PAPERS/2015/M-J/P-12/Q 18

(a) Factorise completely $p^2q - pq$.

$p^2q - pq$

$pq(p - 1)$

(b) **(i)** Factorise $5x^2 + x - 4$.

$5x^2 + x - 4$

$5x^2 + 5x - 4x - 4$

$5x(x + 1) - 4(x + 1)$

$(x + 1)(5x - 4)$

(ii) Hence solve $5x^2 + x - 4 = 0$.

$5x^2 + x - 4 = 0$

$(x + 1)(5x - 4) = 0$

$x + 1 = 0$, $5x - 4 = 0$

$x = -1,$ $5x = 4$

$x = -1,$ $x = \frac{4}{5}$

$x = -1,$ $x = 0.8$

PAST PAPERS/2014/O-N/P-12/Q 18

(a) Factorise completely $4a - 16a^2$.

$\mathbf{4a - 16a^2}$

$\mathbf{4a(1 - 4a)}$

(b) Factorise $9b^2 - c^2$.

$\mathbf{9b^2 - c^2}$

$\mathbf{(3b)^2 - (c)^2}$

$\mathbf{(3b + c)(3b - c)}$

(c) Factorise $x^2 - 5y - xy + 5x$.

$\mathbf{x^2 - 5y - xy + 5x}$

$\mathbf{x^2 - xy + 5x - 5y}$

$\mathbf{x(x - y) + 5(x - y)}$

$\mathbf{(x - y)(x + 5)}$

PAST PAPERS/2014/M-J/P-12/Q 23

(a) Expand and simplify $(2x+1)(x+4)$.

$$(2x+1)(x+4)$$

$$2x(x+4)+1(x+4)$$

$$2x^2+8x+x+4$$

$$2x^2+9x+4$$

PAST PAPERS/2014/M-J/P-12/Q 23

(c) Solve $\frac{10}{x} = x + 3$.

$$\frac{10}{x} = x + 3$$

$$x(x + 3) = 10$$

$$x^2 + 3x = 10$$

$$x^2 + 3x - 10 = 0$$

$$x^2 + 5x - 2x - 10 = 0$$

$$x(x + 5) - 2(x + 5) = 0$$

$$(x + 5)\ (x - 2) = 0$$

$$x + 5 = 0 \ , \quad x - 2 = 0$$

$$x = -5, \qquad x = 2$$

PAST PAPERS/2013/O-N/P-12/Q 17

(a) Factorise $25t^2 - 4$.

$25t^2 - 4$

$(5t)^2 - (2)^2$

$(5t + 2)(5t - 2)$

(b) Factorise completely $6r^2H - 2r^2h$.

$6r^2H - 2r^2\mathrm{h}$

$2r^2(3H - h)$

(c) Factorise completely $8xy + 4x - 6y - 3$.

$8xy + 4x - 6y - 3$

$\underline{8xy + 4x} - \underline{6y - 3}$

$4x(2y + 1) - 3(2y + 1)$

$(2y + 1)(4x - 3)$

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(b) Expand the brackets and simplify

$(3x^2 - 1)(2x + 3) - x(9x - 2)$.

$$3x^2(2x + 3) - 1(2x + 3) - x(9x - 2)$$

$$6x^3 + 9x^2 - 2x - 3 - 9x^2 + 2x$$

$$6x^3 + \cancel{9x^2} - \cancel{9x^2} + \cancel{2x} - \cancel{2x} - 3$$

$$6x^3 - 3$$

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

PAST PAPERS/2013/O-N/P-22/Q 3

(c) (i) Factorise $9x^2 + 5x - 4$.

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

$$\mathbf{9x^2 + 9x - 4x - 4}$$

$$\mathbf{9x(x + 1) - 4(x + 1)}$$

$$\mathbf{(x + 1)(9x - 4)}$$

(ii) Use your answer to **part (c)(i)** to solve the equation

$9x^2 + 5x - 4 = 0.$

$$(x + 1)(9x - 4) = 0$$

$$x + 1 = 0 \quad , \quad 9x - 4 = 0$$

$$x = -1 \quad , \quad 9x = 4$$

$$x = -1 \quad , \quad x = \frac{4}{9}$$

$$x = -1 \quad , \quad x = 0.44$$

PAST PAPERS/2013/M-J/P-12/Q 24

(a) Expand and simplify $(t-5)(t+3)$.

$(t-5)(t+3)$

$t(t+3) - 5(t+3)$

$t^2 + 3t - 5t - 15$

$t^2 - 2t - 15$

(b) Factorise $64x^2 - 9y^2$.

$64x^2 - 9y^2$

$(8x)^2 - (3y)^2$

$(8x + 3y)(8x - 3y)$

PAST PAPERS/2013/M-J/P-12/Q 24

(c) Factorise $6ab - 2a - 3a^2 + 4b$.

$$6ab - 2a - 3a^2 + 4b$$

$$6ab + 4b - 3a^2 - 2a$$

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

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

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(d) (i) Write $x^2 - 6x + 3$ in the form $(x - a)^2 + b$.

$$x^2 - 6x + 3$$

$$(x^2) - (6x) + \left(\frac{6}{2}\right)^2 + 3 - \left(\frac{6}{2}\right)^2$$

$$(x^2 - 6x + (3)^2) + 3 - 9$$

$$(x - 3)^2 - 6$$

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(ii) Hence solve $x^2 - 6x + 3 = 0$ leaving your answer in the form $p \pm \sqrt{q}$.

$$x^2 - 6x + 3 = 0$$

$$(x - 3)^2 - 6 = 0$$

$$(x - 3)^2 = 6$$

$$(x - 3) = \sqrt{6}$$

$$x - 3 = \pm\sqrt{6}$$

$$x = 3 \pm \sqrt{6}$$

PAST PAPERS/2012/O-N/P-12/Q 7

Expand the brackets and simplify

(a) $6k - 2(1 - k) + 3$,

$$6k - 2(1 - k) + 3$$

$$6k - 2 + 2k + 3$$

$$6k + 2k + 3 - 2$$

$$8k + 1$$

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

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

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

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

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

PAST PAPERS/2012/O-N/P-12/Q 15

Factorise completely

(a) $16p + 4p^2$,

$\mathbf{16p + 4p^2}$

$\mathbf{4p(4 + p)}$

(b) $xy + 2ay + 3ax + 6a^2$.

$\mathbf{xy + 3ax + 2ay + 6a^2}$

$\mathbf{x(y + 3a) + 2a(y + 3a)}$

$\mathbf{(y + 3a)(x + 2a)}$

PAST PAPERS/2012/O-N/P-22/Q 2

(a) Factorise $4x^2 - 1$.

$$\mathbf{4x^2 - 1}$$

$$\mathbf{(2x)^2 - (1)^2}$$

$$\mathbf{(2x + 1)(2x - 1)}$$

PAST PAPERS/2012/M-J/P-12/Q 25

(a) Factorise

(i) $x^2 + x - 12$,

$$x^2 + 4x - 3x - 12$$

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

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

(ii) $25x^2 - 4y^2$.

$$(5x)^2 - (2y)^2$$

$$(5x + 2y)(5x - 2y)$$

Quadratic Formula

PAST PAPERS/2020/M-J/P-22/Q 5B

5 (b) Solve the equation $2x^2 = 3(8-x)$.
Show all your working and give your answers correct to 2 decimal places.

$2x^2 = 3(8 - x)$

$2x^2 = 24 - 3x$

$2x^2 + 3x - 24 = 0$

$a = 2, \quad b = 3, \quad c = -24$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(3) \pm \sqrt{(3)^2 - 4(2)(-24)}}{2(2)}$$

$$x = \frac{-3 \pm \sqrt{9 + 192}}{4}$$

$$x = \frac{-3 \pm \sqrt{201}}{4}$$

$$x = \frac{-3 \pm 14.2}{4}$$

$$x = \frac{-3 + 14.2}{4} \qquad x = \frac{-3 - 14.2}{4}$$

$$x = \frac{11.2}{4} \qquad x = \frac{-17.2}{4}$$

$x = 2.79$ $\qquad$ $x = 4.29$

PAST PAPERS/2019/O-N/P-22/Q 9

9 (c) Solve the equation $x^2 - 22x + 30 = 0$.
Show your working and give your answers correct to 2 decimal places.

$$x^2 - 22x + 30 = 0$$

$$a = 1, \quad b = -22, \quad c = 30$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-22) \pm \sqrt{(-22)^2 - 4(1)(30)}}{2(1)}$$

$$x = \frac{22 \pm \sqrt{484 - 120}}{2}$$

$$x = \frac{22 \pm \sqrt{364}}{2}$$

$$x = \frac{22 \pm 19.1}{2}$$

$$x = \frac{22 + 19.1}{2}, \quad x = \frac{22 - 19.1}{2}$$

$$x = \frac{41.1}{2}, \quad x = \frac{2.9}{2}$$

$$x = 20.6, \quad x = 1.46$$

PAST PAPERS/2018/O-N/P-22/Q 3

(c) Solve $3(x^2 + 3) = 11x$.

Show your working and give your answers correct to 3 significant figures.

$$3(x^2 + 3) = 11x$$

$$3x^2 - 11x + 9 = 0$$

$$a = 3, \quad b = -11 \quad c = 9$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-11) \pm \sqrt{(-11)^2 - 4(3)(9)}}{2(3)}$$

$$x = \frac{11 \pm \sqrt{121 - 108}}{6}$$

$$x = \frac{11 \pm \sqrt{13}}{6}$$

$$x = \frac{11 \pm 3.6}{6}$$

$$x = \frac{11 + 3.6}{6} \qquad x = \frac{11 - 3.6}{6}$$

$$x = \frac{14.6}{6} \qquad x = \frac{8.6}{6}$$

$$x = 2.43 \qquad x = 1.23$$

PAST PAPERS/2017/M-J/P-22/Q 5

(c) Solve $3x^2 - x - 5 = 0$, giving your answers correct to 2 decimal places.

$$3x^2 - x - 5 = 0$$

$$a = 3, \quad b = -1 \quad c = -5$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(3)(-5)}}{2(3)}$$

$$x = \frac{1 \pm \sqrt{1 + 60}}{6}$$

$$x = \frac{1 \pm \sqrt{61}}{6}$$

$$x = \frac{1 \pm 7.8}{6}$$

$$x = \frac{1 + 7.8}{6} \qquad x = \frac{1 - 7.8}{6}$$

$$x = \frac{8.8}{6} \qquad x = \frac{-6.8}{6}$$

$$x = 1.47 \qquad x = -1.14$$

PAST PAPERS/2015/O-N/P-22/Q 7

(c) (i) Solve the equation $2x^2 - 19x + 6 = 0$, giving your answers correct to 2 decimal places.

$2x^2 - 19x + 6 = 0$

$a = 2 \quad b = -19 \quad c = 6$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-19) \pm \sqrt{(-19)^2 - 4(2)(6)}}{2(2)}$$

$$x = \frac{19 \pm \sqrt{361 - 48}}{4}$$

$$x = \frac{19 \pm \sqrt{311}}{4}$$

$$x = \frac{19 \pm 17.6}{4}$$

$$x = \frac{19 + 17.6}{4} \qquad x = \frac{19 - 17.6}{4}$$

$$x = \frac{36.6}{4} \qquad x = \frac{2.6}{4}$$

$$x = 9.15 \qquad x = 0.65$$

(d) Solve the equation $3y^2 + 11y + 4 = 0$.
Give your answers correct to 2 decimal places.

$$3y^2 + 11y + 4 = 0$$

$$a = 3 \qquad b = 11 \qquad c = 4$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(11) \pm \sqrt{(11)^2 - 4(3)(4)}}{2(3)}$$

$$x = \frac{-11 \pm \sqrt{121 - 48}}{6}$$

$$x = \frac{-11 \pm \sqrt{73}}{6}$$

$$x = \frac{-11 \pm 8.5}{6}$$

$$x = \frac{-11 + 8.5}{6} \qquad x = \frac{-11 - 8.5}{6}$$

$$x = \frac{-2.5}{6} \qquad x = \frac{-19.5}{6}$$

$$x = -0.41 \qquad x = -3.25$$

Substitution

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(b) Given that $4x = 3y$, find the numerical value of $\frac{8x+y}{y}$.

$\frac{8x+y}{y}$

$\frac{2(4x)+y}{y}$

$\frac{2(3y)+y}{y}$

$\frac{6y+y}{y}$

$\frac{7y}{y}$

7

PAST PAPERS/2020/M-J/P-12/Q 11

(a) $c = \dfrac{7-a}{b}$

Find c when $a = -4$ and $b = 2$.

$$\boldsymbol{c = \frac{7-a}{b}}$$

$\boldsymbol{a = -4}$

$$\boldsymbol{c = \frac{7-(-4)}{2}}$$

$\boldsymbol{b = 2}$

$$\boldsymbol{c = \frac{7+4}{2}}$$

$$\boldsymbol{c = \frac{11}{2}}$$

$$\boldsymbol{c = 5.5}$$

(b) $y = 5^x + 1$

Find y when $x = -2$.

$$\boldsymbol{y = 5^x + 1}$$

$$\boldsymbol{y = 5^{-2} + 1}$$

$$\boldsymbol{y = \frac{1}{5^2} + 1}$$

$$\boldsymbol{y = \frac{1}{25} + 1}$$

$$\boldsymbol{y = 0.04 + 1}$$

$$\boldsymbol{y = 1.04}$$

$$r = \frac{4p+2}{3-p}$$

(a) Find r when $p = -2$.

$$\boldsymbol{r = \frac{4p+2}{3-p}}$$

$$\boldsymbol{r = \frac{4(-2)+2}{3-(-2)}} \qquad \boldsymbol{p = -2}$$

$$\boldsymbol{r = \frac{-8+2}{3+2}}$$

$$\boldsymbol{r = -\frac{6}{5}}$$

PAST PAPERS/2016/O-N/P-22/Q 7

(a) $x = \sqrt{a^2 + b^2}$

(i) Calculate x when $a = -0.73$ and $b = 1.84$.

$$\boldsymbol{x = \sqrt{a^2 + b^2}}$$

$$\boldsymbol{x = \sqrt{(-0.73)^2 + (1.84)^2}}$$

$$\boldsymbol{x = \sqrt{0.5329 + 3.3856}}$$

$$\boldsymbol{x = \sqrt{3.9185}}$$

$$\boldsymbol{x = 1.97}$$

PAST PAPERS/2014/O-N/P-22/Q 8

(a) $T = 2\pi\sqrt{\frac{h}{g}}$

(i) Find T when $h = 125$ and $g = 981$.

$$\boldsymbol{T = 2\pi\sqrt{\frac{h}{g}}}$$

$$\boldsymbol{T = 2\pi\sqrt{\frac{125}{981}}}$$

$$\boldsymbol{T = 2\pi(0.357)}$$

$$\boldsymbol{T = 2.24}$$

PAST PAPERS/2013/O-N/P-22/Q 3

(a) Find the value of $\dfrac{a+\sqrt{a^2+b^2}}{a^2-2ab}$ when $a=-4$ and $b=-3$.

Give your answer as a fraction.

$$\frac{\boldsymbol{a+\sqrt{a^2+b^2}}}{\boldsymbol{a^2-2ab}}$$

$$\frac{\boldsymbol{(-4)+\sqrt{(-4)^2+(-3)^2}}}{\boldsymbol{(-4)^2-2(-4)(-3)}}$$

$$\frac{\boldsymbol{-4+\sqrt{16+9}}}{\boldsymbol{16-24}}$$

$$\frac{\boldsymbol{-4+\sqrt{25}}}{\boldsymbol{16-24}}$$

$$\frac{\boldsymbol{-4+5}}{\boldsymbol{-8}}$$

$$\boldsymbol{-\frac{1}{8}}$$

$$\boldsymbol{-\frac{1}{8}}$$

PAST PAPERS/2012/O-N/P-22/Q 2

(b) $P = \dfrac{2Q + R}{R}$

(i) Find P when $R = Q$.

$$\boldsymbol{P = \frac{2Q + R}{R}}$$

$$\boldsymbol{P = \frac{2Q + Q}{Q}}$$

$$\boldsymbol{P = \frac{3\cancel{Q}}{\cancel{Q}}}$$

$$\boldsymbol{P = 3}$$

$$c = \frac{b(a-b)}{a}$$

(a) Find c when $a = 4$ and $b = -2$.

$$\boldsymbol{c = \frac{b(a-b)}{a}}$$

$$\boldsymbol{c = \frac{(-2)(4--2)}{4}}$$

$$\boldsymbol{c = \frac{(-2)(6)}{4}}$$

$$\boldsymbol{c = -\frac{12}{4}}$$

$$\boldsymbol{c = -3}$$

Rearranging

PAST PAPERS/2019/O-N/P-22/Q 6

6 (a) Rearrange the formula $v = \frac{3}{p+5}$ to make p the subject.

$$v = \frac{3}{p+5}$$

$$v(p+5) = 3$$

$$pv + 5v = 3$$

$$pv = 3 - 5v$$

$$p = \frac{3-5v}{v}$$

(b) Rearrange the formula to make p the subject.

$$r = \frac{4p + 2}{3 - p}$$

$$r(3 - p) = 4p + 2$$

$$3r - pr = 4p + 2$$

$$3r - 2 = 4p + pr$$

$$3r - 2 = p(4 + r)$$

$$p(4 + r) = 3r - 2$$

$$p = \frac{3r - 2}{4 + r}$$

PAST PAPERS/2016/O-N/P-22/Q 7

(ii) Express b in terms of x and a.

$$x = \sqrt{a^2 + b^2}$$

$$(x)^2 = \left(\sqrt{a^2 + b^2}\right)^2$$

$$x^2 = a^2 + b^2$$

$$a^2 + b^2 = x^2$$

$$b^2 = x^2 - a^2$$

$$b = \sqrt{x^2 - a^2}$$

PAST PAPERS/2016/M-J/P-12/Q 26

(a) Make p the subject of the formula $t = \frac{p+3}{p-4}$.

$$t = \frac{p+3}{p-4}$$

$$t(p-4) = p+3$$

$$pt - 4t = p+3$$

$$pt - p = 4t + 3$$

$$p(t-1) = 4t+3$$

$$p = \frac{4t+3}{t-1}$$

(a) $T = 2\pi\sqrt{\frac{h}{g}}$

(ii) Make h the subject of the formula.

$$T = 2\pi\sqrt{\frac{h}{g}}$$

$$T^2 = \left(2\pi\sqrt{\frac{h}{g}}\right)^2$$

$$T^2 = 4\pi^2\frac{h}{g}$$

$$gT^2 = 4\pi^2 h$$

$$4\pi^2 h = gT^2$$

$$h = \frac{gT^2}{4\pi^2}$$

PAST PAPERS/2012/O-N/P-22/Q 2

(b) $P = \dfrac{2Q + R}{R}$

(ii) Rearrange the formula to make R the subject.

$$\boldsymbol{P = \frac{2Q + R}{R}}$$

$$\boldsymbol{PR = 2Q + R}$$

$$\boldsymbol{PR - R = 2Q}$$

$$\boldsymbol{PR - R = 2Q}$$

$$\boldsymbol{R(P - 1) = 2Q}$$

$$\boldsymbol{R = \frac{2Q}{P - 1}}$$

(b) Rearrange the formula to make a the subject.

$$c = \frac{b(a-b)}{a}$$

$$b(a-b) = ac$$

$$ab - b^2 = ac$$

$$ab - ac = b^2$$

$$a(b-c) = b^2$$

$$a = \frac{b^2}{b-c}$$

Algabraic Manipulation

PAST PAPERS/2020/O-N/P-22/Q 5

(b) Simplify $\frac{6t^2v^3}{5} \div \frac{3t^2}{v^2}$.

$$= \frac{6\,t^2v^3}{5} \times \frac{v^2}{3\,t^2}$$

$$= \frac{6\,t^2v^3}{5} \times \frac{v^2}{3\,t^2}$$

$$= \frac{2\,v^5}{5}$$

PAST PAPERS/2020/O-N/P-22/Q 5

(c) Simplify $\frac{x^2-16}{3x^2+10x-8}$.

$$= \frac{x^2-16}{3x^2+10x-8}$$

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

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

$x^2 - 16$

$(x)^2 - (4)^2$

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

$3x^2 + 10x - 8$

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

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

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

PAST PAPERS/2019/O-N/P-22/Q 6

(b) Express as a single fraction in its simplest form $\frac{x}{2x-5}+\frac{3}{x-6}$.

$$\frac{x}{2x-5}+\frac{3}{x-6}$$

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

$$\frac{x^2-6x+6x-15}{(2x-5)(x-6)}$$

$$\frac{x^2-15}{(2x-5)(x-6)}$$

PAST PAPERS/2019/M-J/P-22/Q 5

(a) Express as a single fraction, in its simplest form.

(ii) $\dfrac{b^2-9}{6} \times \dfrac{2}{b-3}$

$$\frac{b^2-3^2}{6} \times \frac{2}{(b-3)}$$

$$\frac{(b-3)(b+3)}{6} \times \frac{2}{(b-3)}$$

$$\frac{(b+3)}{3}$$

PAST PAPERS/2018/O-N/P-22/Q 3

(b) Simplify $\dfrac{2v^2 - 5v - 12}{v^2 - 16}$.

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

$$\frac{(2v+3)}{(v+4)}$$

$$2v^2 - 5v - 12$$

$$2v^2 - 8v + 3v - 12$$

$$2v(v-4) \quad +3(v-4)$$

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

$$v^2 - 16$$

$$v^2 - 4^2$$

$$(v+4)(v-4)$$

PAST PAPERS/2018/M-J/P-12/Q 9

Express each of the following as a single fraction in its simplest form.

(b) $\frac{5}{2b^2} \div \frac{15}{4b^3}$

$$\frac{5}{2b^2} \div \frac{15}{4b^3}$$

$$\frac{\cancel{5}}{\cancel{2b^2}} \times \frac{\overset{2}{\cancel{4b^3}}}{\underset{3}{\cancel{15}}}$$

$$\frac{1}{\cancel{b^2}} \times \frac{\cancel{2b^2} \times b}{3}$$

$$\frac{2b}{3}$$

PAST PAPERS/2017/M-J/P-12/Q 23

(b) Simplify fully $\dfrac{4x^2-9}{2x^2-13x+15}$.

$$\frac{4x^2-9}{2x^2-13x+15}$$

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

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

$$4x^2-9$$

$$(2x)^2-(3)^2$$

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

$$2x^2-13x+15$$

$$2x^2-10x-3x+15$$

$$2x(x-5)-3(x-5)$$

$$(x-5)(2x-3)$$

PAST PAPERS/2016/O-N/P-22/Q 2

(a) Simplify $\frac{3a^2}{10bc} \div \frac{9a}{5b^2c}$.

$$\frac{3a^2}{10bc} \div \frac{9a}{5b^2c}$$

$$\frac{\cancel{3}a^2}{\cancel{10}_{2}bc} \times \frac{\cancel{5}b^2c}{\cancel{9}_{3}a}$$

$$\frac{\cancel{a} \times a}{2 \times \cancel{b} \times \cancel{c}} \times \frac{\cancel{b} \times b \times \cancel{c}}{3 \times \cancel{a}}$$

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

$$\frac{ab}{6}$$

PAST PAPERS/2016/O-N/P-22/Q 2

(b) Simplify $\dfrac{h-k}{5h-5k}$.

$$\frac{(h-k)}{5h-5k}$$

$$\frac{(h-k)}{5(h-k)}$$

$$\frac{\cancel{(h-k)}}{5\cancel{(h-k)}}$$

$$\frac{1}{5}$$

PAST PAPERS/2016/M-J/P-12/Q 26

(b) Simplify fully $\dfrac{4x^2-1}{2x^2-9x-5}$.

$$\frac{4x^2-1}{2x^2-9x-5}$$

$$\frac{(2x+1)(2x-1)}{(x-5)(2x+1)}$$

$$\frac{(2x-1)}{(x-5)}$$

$$4x^2-1$$

$$(2x)^2-(1)^2$$

$$(2x+1)(2x-1)$$

$$2x^2-9x-5$$

$$2x^2-10x+1x-5$$

$$2x(x-5)\quad +1(x-5)$$

$$(x-5)(2x+1)$$

Single Fraction

PAST PAPERS/2020/M-J/P-12/Q 5

23 Express as a single fraction in its simplest form.

$$\frac{5}{2x-1}-\frac{3}{x+4}$$

$$\frac{\mathbf{5(x+4)-3(2x-1)}}{\mathbf{(2x-1)(x+4)}}$$

$$\frac{\mathbf{5x+20-6x+3}}{\mathbf{(2x-1)(x+4)}}$$

$$\frac{\mathbf{20+3-6x+5x}}{\mathbf{(2x-1)(x+4)}}$$

$$\frac{\mathbf{23-x}}{\mathbf{(2x-1)(x+4)}}$$

PAST PAPERS/2019/O-N/P-22/Q 6

6 (b) Express as a single fraction in its simplest form $\frac{x}{2x-5}+\frac{3}{x-6}$.

$$\frac{x}{2x-5}+\frac{3}{x-6}$$

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

$$\frac{x^2-6x+6x-15}{(2x-5)(x-6)}$$

$$\frac{x^2-15}{(2x-5)(x-6)}$$

PAST PAPERS/2019/M-J/P-22/Q 5

(a) Express as a single fraction, in its simplest form.

(i) $\frac{3a}{4b} - \frac{a}{6b}$

$$\frac{\mathbf{3a(3) + a(2)}}{\mathbf{12}}$$

$$\frac{\mathbf{9a - 2a}}{\mathbf{12b}}$$

$$\frac{\mathbf{7a}}{\mathbf{12b}}$$

PAST PAPERS/2018/O-N/P-22/Q 3

(a) Express as a single fraction in its simplest form $\frac{3}{y-1} - \frac{5}{y+6}$.

$$\frac{3}{y-1} - \frac{5}{y+6}$$

$$\frac{3(y+6) - 5(y-1)}{(y-1)(y+6)}$$

$$\frac{3y + 18 - 5y + 5}{(y-1)(y+6)}$$

$$\frac{18 + 5 + 3y - 5y}{(y-1)(y+6)}$$

$$\frac{23 - 2y}{(y-1)(y+6)}$$

PAST PAPERS/2018/M-J/P-12/Q 9

Express each of the following as a single fraction in its simplest form.

(a) $\frac{2}{3a}+\frac{5}{2a}$

$$\frac{\mathbf{2}}{\mathbf{3}a}+\frac{\mathbf{5}}{\mathbf{2}a}$$

$$\frac{\mathbf{2(2)+5(3)}}{\mathbf{6}a}$$

$$\frac{\mathbf{4+15}}{\mathbf{6}a}$$

$$\frac{\mathbf{19}}{\mathbf{6}a}$$

PAST PAPERS/2017/O-N/P-22/Q 5

(a) Express as a single fraction in its simplest form $\frac{4}{x-2} - \frac{5}{x+1}$.

$$\frac{4}{(x-2)} - \frac{5}{(x+1)}$$

$$\frac{4(x+1) - 5(x-2)}{(x-2)(x+1)}$$

$$\frac{4x + 4 - 5x + 10}{(x-2)(x+1)}$$

$$\frac{4 + 10 + 4x - 5x}{(x-2)(x+1)}$$

$$\frac{14 - x}{(x-2)(x+1)}$$

PAST PAPERS/2017/M-J/P-22/Q 5

(a) Express as a single fraction, as simply as possible, $\frac{1}{2x}+\frac{2}{5x}$.

$$\frac{\mathbf{1}}{\mathbf{2}\boldsymbol{x}}+\frac{\mathbf{2}}{\mathbf{5}\boldsymbol{x}}$$

$$\frac{\mathbf{1(5)+2(2)}}{\mathbf{(2)(5}\boldsymbol{x}\mathbf{)}}$$

$$\frac{\mathbf{5+4}}{\mathbf{10}\boldsymbol{x}}$$

$$\frac{\mathbf{9}}{\mathbf{10}\boldsymbol{x}}$$

$$\frac{\mathbf{9}}{\mathbf{10}\boldsymbol{x}}$$

PAST PAPERS/2015/O-N/P-12/Q 16

(b) Express $\frac{3}{4x} + \frac{2}{3y}$ as a single fraction.

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

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

$$\frac{\mathbf{9y + 8x}}{\mathbf{12xy}}$$

$$\frac{\mathbf{8x + 9y}}{\mathbf{12xy}}$$

PAST PAPERS/2014/M-J/P-12/Q 23

(b) Write $\frac{3}{x}+\frac{4}{x+2}$ as a single fraction in its simplest form.

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

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

$$\frac{3x+6+4x}{x(x+2)}$$

$$\frac{7x+6}{x(x+2)}$$

PAST PAPERS/2013/M-J/P-12/Q 20

(b) Write as a single fraction in its simplest form $\frac{5}{x+4} + \frac{2}{x-1}$.

$$\frac{5}{x+4} + \frac{2}{x-1}$$

$$\frac{5(x-1) + 2(x+4)}{(x+4)(x-1)}$$

$$\frac{5x - 5 + 2x + 8}{(x+4)(x-1)}$$

$$\frac{5x + 2x - 5 + 8}{(x+4)(x-1)}$$

$$\frac{7x + 3}{(x+4)(x-1)}$$

PAST PAPERS/2012/M-J/P-12/Q 25

(b) Write as a single fraction $\frac{4}{3p} + \frac{1}{6p}$.

$$\frac{4}{3p} + \frac{1}{6p}$$

$$\frac{4(4) + 1(2)}{12p}$$

$$\frac{16 + 2}{12p}$$

3

$$\frac{\cancel{18}}{\cancel{12}p}$$

2

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