**1.** Show that $\frac{1}{6x^2 + 7x - 5} \div \frac{1}{4x^2 - 1}$ simplifies to $\frac{ax + b}{cx + d}$ where $a$, $b$, $c$ and $d$ are integers.

$6x^2+7x-5$

① $6 \times (-5) = -30$

② Find two numbers that multiply to make -30 and add to make 7

$10 \times (-3) = -30$

$10 + (-3) = 7$

Our numbers 10, -3

$(6x + 10)(6x - 3)$ ↓÷2 ↓÷3

$(3x + 5)(2x - 1)$ ← try to simplify each bracket

---

$4x^2 - 1$ ← called difference of two squares

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

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

Factorising quadratics

$6x^2+7x-5 = (3x+5)(2x-1)$

$4x^2-1 = (2x+1)(2x-1)$ ✓

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

use rule

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c} = \frac{ad}{bc}$$

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

$$\frac{2x+1}{3x+5}$$ ✓

**2.** $2 - \frac{x+2}{x-3} - \frac{x-6}{x+3}$ can be written as a single fraction in the form $\frac{ax+b}{x^2-9}$ where $a$ and $b$ are integers.

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

Work out the value of $a$ and the value of $b$.

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

$$= \frac{2(x^2-9) - (x+2)(x+3) - (x-6)(x-3)}{x^2-9}$$

$$= \frac{(2x^2-18) - (x^2+5x+6) - (x^2-9x+18)}{x^2-9}$$ (1)

(1)

$$= \frac{2x^2-18-x^2-5x-6-x^2+9x-18}{x^2-9} = \frac{4x-42}{x^2-9}$$

$a = 4$, $b = -42$ (1)

$a =$ 4

$b =$ −42

**(Total for Question is 4 marks)**

**3.** (a) Simplify $\dfrac{x^2 - 16}{2x^2 - 5x - 12}$

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

(1) $\dfrac{x+4}{2x+3}$

**(3)**

(b) Make $v$ the subject of the formula $w = \dfrac{15(t-2v)}{v}$

$w = \dfrac{15(t-2v)}{v}$

$\times v$ ( ) $\times v$

$wv = 15(t-2v)$

$wv = 15t - 30v$ (1)

$wv + 30v = 15t$ (1)

$v(w+30) = 15t$

$\div (w+30)$ ( ) $\div (w+30)$

$v = \dfrac{15t}{w+30}$

(1) $v = \dfrac{15t}{w+30}$

**(3)**

**(Total for Question is 6 marks)**

**4.** (a) Factorise $a^2 - b^2$

Difference of two squares (D.O.T.S)

$(a+b)(a-b) = a^2 + ab - ab - b^2$
$= a^2 - b^2$

$(a+b)(a-b)$

**(1)**

(b) Hence, or otherwise, simplify fully $(x^2 + 4)^2 - (x^2 - 2)^2$

← use information from part a

$a^2 - b^2$

$a = x^2 + 4$
$b = x^2 - 2$ (1)

$a^2 - b^2 = (a+b)(a-b)$ ← seen in part a

$= ((x^2+4)+(x^2-2))((x^2+4)-(x^2-2))$ (1)
$= (2x^2 + 2) \times 6$
$= 12x^2 + 12$
$= 12(x^2+1)$

$12(x^2+1)$ (1)

**(3)**

**(Total for Question is 4 marks)**

**5.** (a) Simplify $m^3 \times m^4$

Laws of indices

$x^a \times x^b = x^{a+b}$

$m^{3+4} = m^7$

$m^7$

**(1)**

(b) Simplify $(5np^3)^3$

$(5 \times n \times p^3)^3$ – raise each individual term to the power of 3.

$= 5^3 \times n^3 \times (p^3)^3$

$= 125 \times n^3 \times p^9$

$= 125n^3p^9$

Laws of Indices $(x^a)^b = x^{ab}$

$(p^3)^3 = p^9$

① 2 correct terms

$125n^3p^9$ ①

**(2)**

(c) Simplify $\frac{32q^9r^4}{4q^3r}$

$= \frac{32 \times q^9 \times r^4}{4 \times q^3 \times r}$

$= \frac{32}{4} \times \frac{q^9}{q^3} \times \frac{r^4}{r}$

$= 8 \times q^{9-3} \times r^{4-1}$

$= 8 \times q^6 \times r^3$

Laws of Indices:

$\frac{x^a}{x^b} = x^{a-b}$

① 2 correct terms

$8q^6r^3$ ①

**(2)**

**(Total for Question is 5 marks)**

doesn't fit trend – far from other points / line of best fit

It is not in line with the trend of the other points

Extrapolation → extending graph beyond plotted points is unreliable as we can't be sure that the trend will continue

The point would be outside of the range of the scatter diagram

**6.** Expand and simplify $5(p + 3) - 2(1 - 2p)$

$((5 \times p) + (5 \times 3)) + ((-2 \times 1) + (-2 \times -2p))$

$= (5p + 15) + (-2 + 4p)$ ① Expanding 1 bracket

$= (5p + 4p) + (15 - 2)$

$= 9p + 13$ ← (13 is prime)

9 and 13 have no common factors, so this can't be simplified further.

$9p + 13$ ①

**(Total for Question is 2 marks)**

**7.** (a) Simplify $\left(\frac{1}{m^2}\right)^0$

$a^0 = 1$

1

**(1)**

(b) Simplify $\frac{8(x-4)}{(x-4)^2}$

$\frac{8(x-4)}{(x-4)(x-4)}$

$\frac{8}{x-4}$

**(1)**

(c) Simplify $(3n^4w^2)^3$

$(abc)^n = a^n b^n c^n$

$(a^x)^y = a^{xy}$

$3^3 (n^4)^3 (w^2)^3 = 27n^{12}w^6$

$27n^{12}w^6$

**(2)**

**(Total for Question is 4 marks)**