

1 (a) Simplify $h^7 \times h^2$

$$h^7 \times h^2 = h^{(7+2)} \\ = h^9$$

$$a^n \times a^m = a^{n+m} \\ a^n \div a^m = a^{n-m} \\ (a^n)^m = a^{n \times m}$$

$$\frac{h^9}{(1)}$$

(Total for Question 1 is 1 marks)

2 (a) Simplify $g^6 \times g^4$

$$g^6 \times g^4 = g^{6+4} = g^{10}$$

$$\frac{g^{10}}{(1)}$$

(b) Simplify $k^{10} \div k^3$

$$\frac{k^{10}}{k^3} = k^{10-3} = k^7$$

$$\frac{k^7}{(1)}$$

(c) Simplify $(3cd^4)^2$

$$\begin{aligned} (3cd^4)^2 &= 3^2 \times c^2 \times d^{4 \times 2} \quad (1) \\ &= 9 \times c^2 \times d^8 \\ &= 9c^2d^8 \quad (1) \end{aligned}$$

$$\frac{9c^2d^8}{(2)}$$

(d) Solve the inequality $4x + 7 > 2$

$$\begin{aligned} 4x + 7 &> 2 \\ 4x &> 2 - 7 \quad (-7) \\ 4x &> -5 \quad (1) \\ x &> -\frac{5}{4} \quad (\div 4) \quad (1) \end{aligned}$$

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

(Total for Question 2 is 6 marks)

3 (d) Simplify fully $\frac{n^4 \times n^7}{n^5}$

$$\frac{n^4 \times n^7}{n^5} = n^{4+7-5} = n^6$$

$$n^6$$

(2)

(Total for Question 3 is 2 marks)

4 (a) Simplify fully $\frac{10x^2 + 23x + 12}{4x^2 - 9}$

Factorising numerator :

$$10x^2 + 23x + 12 \equiv (5x+4)(2x+3) \quad (1)$$

Factorising denominator :

$$4x^2 - 9 \equiv (2x+3)(2x-3) \quad (1)$$

$$\frac{10x^2 + 23x + 12}{4x^2 - 9} \equiv \frac{(5x+4)\cancel{(2x+3)}}{\cancel{(2x+3)}(2x-3)}$$

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

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

(3)

$$2^{2y} \times 2^{3y+2} = \frac{8^{5y}}{4^n}$$

(b) Find an expression for n in terms of y .

Show clear algebraic working and simplify your expression.

$$8^{5y} = (2^3)^{5y}$$

$$= 2^{15y} \quad (1)$$

$$4^n = (2^2)^n$$

$$= 2^{2n}$$

$$2^{2y} \times 2^{3y+2} = \frac{2^{15y}}{2^{2n}}$$

$$2^{2y+3y+2} = 2^{15y-2n} \quad (1)$$

$$2y + 3y + 2 = 15y - 2n$$

$$5y + 2 = 15y - 2n \quad (1)$$

$$2n = 15y - 5y - 2$$

$$2n = 10y - 2$$

$$n = 5y - 1 \quad (1)$$

$$n = 5y - 1$$

(4)

(Total for Question 4 is 7 marks)

5 Express $7 - 12x - 2x^2$ in the form $a + b(x + c)^2$ where a , b and c are integers.

$$-2x^2 - 12x + 7$$

$$-2\left(x^2 + 6x - \frac{7}{2}\right) \text{ ①}$$

$$-2\left[(x+3)^2 - 9 - \frac{7}{2}\right] \text{ ①}$$

$$-2\left[(x+3)^2 - \frac{25}{2}\right]$$

$$-2(x+3)^2 + 25$$

$$\therefore 25 - 2(x+3)^2 \text{ ① where } a = 25$$

$$b = -2$$

$$c = 3$$

$$25 - 2(x+3)^2$$

(Total for Question 5 is 3 marks)

6 (a) Simplify $(16e^{10}f^6)^{\frac{1}{2}}$

$$\begin{aligned} & 16^{\frac{1}{2}} \times (e^{10})^{\frac{1}{2}} \times (f^6)^{\frac{1}{2}} \\ &= 4 \times e^5 \times f^3 \\ &= 4e^5f^3 \quad (2) \end{aligned}$$

$$4e^5f^3$$

(2)

(Total for Question 6 is 2 marks)

7 (a) Simplify $(3k^2)^4$

$$\begin{aligned} & 3^4 \times k^{2 \times 4} \\ & = 81 \times k^8 \\ & = 81 k^8 \end{aligned}$$

$$81 k^8 \quad (2)$$

(2)

(b) Simplify $(21m^4n) \div (3n^{-5})$

$$\begin{aligned} & (21 \div 3) \times (m^4) \times (n \div n^{-5}) \\ & = 7 \times m^4 \times (n^{1-(-5)}) \\ & = 7 \times m^4 \times n^6 \\ & = 7 m^4 n^6 \end{aligned}$$

$$7 m^4 n^6 \quad (2)$$

(2)

(Total for Question 7 is 4 marks)

8 (a) Simplify $(2x^3y^5)^4$

$$= (2x^3y^5)^4$$

$$= 2^4 \times x^{3 \times 4} \times y^{5 \times 4}$$

$$= 16 \times x^{12} \times y^{20}$$

$$= 16x^{12}y^{20} \text{ (2)}$$

$$16x^{12}y^{20}$$

(2)

(Total for Question 8 is 2 marks)

9 (b) Express $\frac{7}{8} - \frac{x+3}{4x}$ as a single fraction in its simplest form.

$$\frac{7(4x)}{32x} - \frac{8(x+3)}{32x} \quad (1)$$

$$= \frac{28x}{32x} - \frac{8x+24}{32x}$$

$$= \frac{28x - 8x - 24}{32x} \quad (1)$$

$$= \frac{20x - 24}{32x} = \frac{5x - 6}{8x} \quad (1)$$

$$\frac{5x - 6}{8x}$$

(3)

(Total for Question 9 is 3 marks)

10 $a = \frac{14}{3x-7}$ $x = \frac{7}{4y-3}$

Express a in the form $\frac{py+q}{ry+s}$ where p, q, r and s are integers.

Give your answer in its simplest form.

$$a = \frac{14}{3\left(\frac{7}{4y-3}\right)-7} \quad (1)$$

$$= \frac{14}{\frac{21}{4y-3} - 7}$$

$$= \frac{14(4y-3)}{21 - 7(4y-3)} \quad (1)$$

$$= \frac{56y - 42}{21 - 28y + 21}$$

$$= \frac{56y - 42}{42 - 28y}$$

$$= \frac{14(4y-3)}{14(3-2y)} \quad (1)$$

$$a = \frac{4y-3}{3-2y}$$

(Total for Question 10 is 3 marks)

11

$$\frac{18 \times (\sqrt{27})^{4n+6}}{6 \times 9^{2n+8}} = 3^x$$

Express x in terms of n

Show your working clearly and simplify your expression.

$$\frac{\cancel{18} \times \cancel{3} \times 3 \times (3^{\frac{3}{2}})^{4n+6}}{\cancel{6} \times \cancel{9} \times 3^{2(2n+8)}} \quad (1)$$

$$\frac{3 \times 3^{6n+9}}{3^{4n+16}} = \frac{3^2 \times 3^{6n+9}}{3 \times 3^{4n+16}} \quad (1) = 3^x$$

$$= \frac{3^{6n+11}}{3^{4n+17}} = 3^x$$

$$3^{6n+11} = 3^x \times 3^{4n+17}$$

$$6n+11 = x + 4n+17$$

$$x = 2n - 6 \quad (1)$$

$$x = \dots\dots\dots 2n-6$$

(Total for Question 11 is 3 marks)

12 (b) Simplify $(3a^2b^4)^3$

$$3^3 \times a^{2(3)} \times b^{4(3)} \quad (1)$$
$$= 27a^6b^{12} \quad (1)$$

$$27a^6b^{12}$$

(2)

(Total for Question 12 is 2 marks)

13 Simplify $(x^2 - 4) \div \left(\frac{4x^2 - 7x - 2}{x} \right) - 2x$

Give your answer in the form $\frac{ax^2}{bx + c}$ where a , b and c are integers.

$$x^2 - 4 = (x-2)(x+2) \quad (1)$$

$$4x^2 - 7x - 2 = (4x+1)(x-2)$$

$$\cancel{(x-2)}(x+2) \times \frac{x}{(4x+1)\cancel{(x-2)}} - 2x \quad (1)$$

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

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

$$= \frac{x^2 + 2x - 8x^2 - 2x}{4x+1}$$

$$= \frac{-7x^2}{4x+1} \quad (1)$$

$$\frac{-7x^2}{4x+1}$$

(Total for Question 13 is 4 marks)