Show all necessary working and set your work out in a neat and logical manner.

1. Simplify these expressions.

   (a) $3x^2 \times 5x^3$

   (b) $15a^3b^5 \div 3ab$

   (c) $\dfrac{3a \times 3a \times 3a}{3a + 3a + 3a}$

   (d) $(-3ab^2)^3$

   (e) $\dfrac{(2w^3)^3 \times 6w^2}{3w^4 \times 4w^5}$

   (f) $(6x^2y^3)^2 \div 3x^2y^3$

2. Express the following terms in their simplest form without negative indices:

   (a) a^{-2}

   (b) $\left(\dfrac{3}{4}\right)^{-1}$

   (c) $\left(\dfrac{a}{b}\right)^{-2}$

   (d) $(5m^{-1})^2$

   (e) $3^m \div 3^{-m}$

   (f) $x^{-\frac{3}{4}} \times x^{\frac{1}{4}}$

   (g) $\dfrac{a^{-1}}{a^{-3}}$

   (h) $5^{2x+1} \div 5^{x-1}$

3. Evaluate:

   (a) $9^{\frac{1}{2}}$

   (b) $27^{\frac{2}{3}}$

   (c) $\left(\dfrac{8}{125}\right)^{-\frac{2}{3}}$

   (d) $8^{-\frac{2}{3}}$

   (e) $\left(\dfrac{25}{4}\right)^{-\frac{3}{2}}$

   (f) $\left(-\dfrac{27}{8}\right)^{-\frac{4}{3}}$

4. (a) Find the value of x^2y^{-1} given $x = 3$ and $y = \frac{3}{4}$.

   (b) Evaluate $a^{-2} \div bc^{-1}$ when $a = -2, b = -1$ and $c = \frac{1}{2}$.

5. Use the index laws to simplify the following expressions, giving your answer in terms of positive indices.

   (a) $\dfrac{15b^3c^4}{3bc^{-4}}$

   (b) $\left(\dfrac{2a^2b^3}{b^{-3}}\right)^{-2}$

   (c) $\dfrac{7a^{-5}b^2}{(-2a^3b)^2} \div \dfrac{21a^{-3}b^2}{4a^{-1}b}$

   (d) $\sqrt{\dfrac{b^{4m} \times b^{2n}}{b^{4m+2n}}}$

FORM III INDICES

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QUESTION 1

(a) $3x^2 \times 5x^3 = 15x^5$ ✓

(b) $15a^3b^5 \div 3ab = 5a^2b^4$ ✓

(c) $\frac{3a \times 3a \times 3a}{3a + 3a + 3a} = \frac{27a^3}{9a}$ ✓

$= 3a^2$ ✓

(d) $(-3ab^2)^3 = -27a^3b^6$ ✓

(e) $\frac{(2w^3)^3 \times 6w^2}{3w^4 \times 4w^5}$

$= \frac{48w^{11}}{12w^9}$ ✓

$= 4w^2$ ✓

(f) $(6x^2y^3)^2 \div 3x^2y^3$

$= 36x^4y^6 \div 3x^2y^3$ ✓

$= 12x^2y^3$ ✓ (9)

QUESTION 2

(a) $a^{-2} = \frac{1}{a^2}$ ✓

(b) $\left(\frac{3}{4}\right)^{-1} = \frac{4}{3}$ ✓

(c) $\left(\frac{a}{b}\right)^{-2} = \frac{b^2}{a^2}$ ✓

(d) $(5m^{-1})^2 = \frac{25}{m^2}$ ✓

(e) $3^m \div 3^{-m} = 3^{2m}$ ✓

(f) $x^{-3/4} \times x^{1/4} = x^{-\frac{1}{2}}$ ✓

$= \frac{1}{\sqrt{x}}$ ✓

(g) $\frac{a^{-1}}{a^{-3}} = a^2$ ✓

(h) $5^{2x+1} \div 5^{x-1} = 5^{2x+1-(x-1)}$

$= 5^{x+2}$ ✓ (9)

QUESTION 3

(a) $9^{\frac{1}{2}} = 3$ ✓

(b) $27^{\frac{2}{3}} = 9$ ✓

(c) $\left(\frac{8}{125}\right)^{+\frac{2}{3}} = \frac{25}{4}$ ✓

(d) $8^{-\frac{2}{3}} = \frac{1}{4}$ ✓

(e) $\left(\frac{25}{4}\right)^{-\frac{3}{2}} = \frac{8}{125}$ ✓

(f) $\left(-\frac{27}{8}\right)^{-\frac{4}{3}} = \frac{16}{81}$ ✓ (10)

QUESTION 4

(a) $x^2y^{-1} = 3^2 \times \left(\frac{3}{27}\right)^{-1}$ ✓

$= 9 \times \frac{4}{3}$

$= 12$ ✓

(b) $a^{-2} \div bc^{-1} = (-2)^{-2} \div (-1)\left(\frac{1}{2}\right)^{-1}$ ✓

$= \frac{1}{4} \div -1 \times 2$

$= -\frac{1}{4} \times 2$

$= -\frac{1}{2}$ ✓ (4)

QUESTION 5

(a) $\frac{15b^3c^4}{3bc^{-4}} = 5b^2c^8$ ✓✓

(b) $\left(\frac{2a^2b^3}{b^{-3}}\right)^{-2} = \left(2a^2b^6\right)^{-2}$ ✓

$= \frac{1}{4a^4b^{12}}$ ✓

---- cont.

form III indices ... Q5 cont.

(c) $\frac{7a^{-5}b^2}{(-2a^3b^2)^2} \div \frac{21a^{-3}b^2}{4a^{-1}b}$

$= \frac{7a^{-5}b^2}{4a^6b^4} \times \frac{4a^{-1}b}{21a^{-3}b^2}$ ✓

$= \frac{a^{-6}b^3}{3a^3b^6}$

$= \frac{1}{3a^9b^3}$ ✓

(d) $\sqrt{\frac{b^{4m} \times b^{2n}}{b^{4m+2n}}} = \sqrt{\frac{b^{4m+2n}}{b^{4m+2n}}}$ ✓

$= \sqrt{1}$

$= 1$ ✓ (8)