

Year 9 Term 3 Homework

Student Name: _____	Grade: _____
Date: _____	Score: _____

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1 Year 9 Term 3 Week 1 Homework

1.1 Indices

1.1.1 Index notation

The expression 3^5 , 3 is the base and 5 is the index, power or exponent (five factors of three).

Exercise 1.1.1 Express each of the following expressions in index form:

1. $3 \times 3 \times 3 \times 3 \times 3 =$ _____

2. $5 \times 5 \times 5 \times 3 \times 3 =$ _____

3. $3 \times m \times m \times m \times 2 =$ _____

4. $a \times a \times a - b \times b =$ _____

5. $5 \times c \times c \times c + 2 \times d \times d \times d =$ _____

6. $x \times y \times y \times x \times x =$ _____

7. $400 =$ _____

8. $800 =$ _____

Exercise 1.1.2 Write each of the following in index form:

1. *three factors of 5* = _____

2. *two factors of 3* = _____

3. *four factors of x* = _____

4. *x factors of 6* = _____

5. *n factors of m* = _____

6. *3p factors of 2q* = _____

7. *eight factors of six* = _____

8. *five factors of k* = _____

Exercise 1.1.3

1. Evaluate $2^{2^2} =$ _____

2. Find the value of k if $2^{(2^k)} = 256$ _____

3. What is the units digit of $2^{28} =$ _____

1.1.2 Index laws

- The index law for multiplication: $a^m \times a^n = a^{m+n}$
- The index law for division: $a^m \div a^n = a^{m-n}$
- The index law for further powers: $(a^m)^n = a^{mn}$

Exercise 1.1.4 Simplify each of these expressions:

1. $k^2 \times k^3 \times k^4 =$ _____
2. $c^4 \times c^3 \times c^5 =$ _____
3. $x^8 \div x^3 \div x^2 =$ _____
4. $y^9 \div y^6 \div y^3 =$ _____
5. $(m^4)^3 =$ _____
6. $(2p^6)^2 =$ _____
7. $2m^2 \times 3m^3 \times 4m^4 =$ _____
8. $40k^8 \div 5k^2 \div 2k^3 =$ _____

Exercise 1.1.5

1. $(4x^2)^3 =$ _____
2. $(2q^2 \times 3q^3)^2 =$ _____
3. $a^2b^3 \times a^3 =$ _____
4. $x^3 \times 4x^2y^5 =$ _____
5. $a^6b^4 \div a^3 =$ _____
6. $x^4y^3 \div x^2y =$ _____
7. $45c^4d^6 \div 5c^2d^3 =$ _____
8. $(5x^5y^2)^3 =$ _____
9. $(2x^2 \times 3xy^3)^3 =$ _____
10. $(24x^6y^3 \div 6xy^2)^3 =$ _____

Exercise 1.1.6 Further applications

1. If $2^x = 3$, evaluate $2^{x+1} =$ _____
2. If $2^x = 5$, evaluate $2^{x+3} =$ _____
3. If $3^x = 8$, evaluate $3^{x+4} =$ _____
4. If $2^x = 40$, evaluate $2^{x-1} =$ _____
5. If $2^x = 80$, evaluate $2^{x-4} =$ _____
6. If $5^x = 1000$, evaluate $5^{x-5} =$ _____
7. If $2^x = 3$, evaluate $8^x =$ _____
8. If $3^x = 10$, evaluate $9^x =$ _____

Exercise 1.1.7 Consolidation

1. $(5t^{12})^3 \times t^2 =$ _____
2. $12g^8 \times 11g^4 \div 6g^2 =$ _____
3. $(3p^6)^5 \div p^{10} =$ _____
4. $(2a^3)^4 \times (3a^4)^3 =$ _____
5. $\frac{m^5 \times m^3}{m^6} =$ _____
6. $\frac{24k^{15}}{2k^3 \times 3k^2} =$ _____
7. $\frac{(2d^5)^4}{d^4} =$ _____
8. $\frac{8e^6}{(e^2)^3} =$ _____

Exercise 1.1.8 Simplify the following:

1. $(a^5 \times a^4)^2 =$ _____
2. $(b^9 \div b^2)^3 =$ _____
3. $(c^4 \times c^3 \div c^2)^5 =$ _____
4. $\left(\frac{3m^6}{m^4}\right)^3 =$ _____

1.1.3 Miscellaneous questions on the index laws**Exercise 1.1.9 Simplify the following expressions:**

1. $(5m^3)^2 \times m^6 =$ _____

2. $40n^{16} \div (2n^4)^3 =$ _____

3. $\left(\frac{w^8}{w^3}\right)^3 =$ _____

4. $\frac{(b^5)^3}{(b^6)^2} =$ _____

5. $\frac{5b^4 \times 9b^{10}}{3b^5}$

6. $\frac{8m^{11} \times 10m^4}{5m \times 4m^5}$

7. $\frac{c^{15} \times (c^4)^3}{(c^3)^4 \times c^7}$

8. $(x^9)^5 \div \left(\frac{x^5}{x^2}\right)^7$

9. $\frac{(3u^4)^2 \times 5u^{10}}{u^3 \times (3u^3)^2 \times u^5}$

10. $\frac{10(pq)^2 \times 20p^{20}q^{12}}{(2p^6q^3)^2 \times 5p^4q^2}$

1.1.4 Fractional index

- Index $(\frac{1}{n})$ means the n^{th} root.
- $x^{\frac{1}{2}} = \sqrt{x}$
- $x^{\frac{2}{3}} = \sqrt[3]{x^2}$ or $= (x^2)^{\frac{1}{3}}$, or $= (x^{\frac{1}{3}})^2$; Example: $27^{\frac{2}{3}} = (\sqrt[3]{27})^2 = (3)^2 = 9$

Exercise 1.1.10

1. Simplify the following expressions:

(a) $\frac{5a^{12} \times 3a^3}{25a^5}$

(b) $\frac{(3a^2)^4}{(4a^3)^2}$

(c) $\frac{a^{\frac{3}{4}} \times a^{-\frac{1}{2}}}{a^{\frac{1}{4}}}$

(d) $\frac{(a^{\frac{2}{3}})^4 \times (a^{\frac{3}{4}})}{(a^{\frac{3}{2}})^3 \times a^{\frac{1}{4}}}$

2. Evaluate:

(a) $(81)^{\frac{1}{4}}$

(b) $2^3 \times 64^{\frac{1}{6}}$

(c) $256^{\frac{1}{2}} \times (16)^{-\frac{1}{2}}$

1.1.5 Maths challenge

1. From the following numbers: $2^{-\frac{1}{2}k}$, $2^{\frac{1}{2}k}$, 2^k and 2^{-k} , where k is a positive number, Find:

(a) the largest number _____

(b) the smallest number _____

2. Find the sum of the first 100 terms of the arithmetic progression whose first two terms are 100 and 99.

3. Express the following as a single index number with the smallest possible base:

(a) $\frac{(16^2)^3}{(8^3)^2}$

(b) $\frac{2^{n+3} \times 2^{2n}}{8^{n+1}}$

4. Solve for x and y if:

(a) $(10^4)^y = \frac{1}{10^4} = 10^x$

(b) $(2^y)^3 = 2x^3 = 16$

1.1.6 Miscellaneous exercise**Exercise 1.1.11 Simplify the following:**

1.
$$\frac{(a^4)^6}{-a^3 \times (-a^2)^9}$$

2.
$$\frac{(ab^2)^3}{(a^2b)^4} \times \frac{(a^3b^2)^2}{(b^3)^3}$$

3.
$$\frac{9m^2u}{6n^3u^2} \div \frac{24m}{15mu^2} \times \frac{8n^2}{10m^3u}$$

Exercise 1.1.12 Find the value of x in each of the following:

1.
$$\frac{4}{5}x^3 = 21\frac{3}{5}$$

2.
$$16^{\frac{3x+1}{4}} = 2$$

3.
$$2^{10} \times 2^x = 4^5$$

Exercise 1.1.13

1. Expand and simplify the following:

(a) $(x - y)(x + y)(x^2 + y^2)$

(b) $(2x + 5)^2 - 2x + 5(2x - 5)$

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

(d) $\frac{7}{x^2+3x-10} - \frac{2}{x^2+5x} - \frac{2}{x^2-2x}$

2. How can the number 42 be divided into two parts in order that the sum of $\frac{2}{3}$ of one part and $\frac{3}{4}$ of the other part is 30?

Exercise 1.1.14

1. Solve the following equations:

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

(b) $\frac{6}{x} + \frac{3}{x+1} = 0$

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

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

2. A man travels regularly between two places. He takes $3\frac{1}{4}$ hours if he travels at his usual speed. He finds that if he increase his speed by 4 km/h, he can reduce the time taken by 10 minutes. What is his usual speed?
