

Year 9 Term 3 Homework

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

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This edition was printed on October 6, 2010.

Camera ready copy was prepared with the **L^AT_EX²_ε** typesetting system.

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2 Year 9 Term 3 Week 2 Homework

2.1 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: $(a^m)^n = a^{mn}$
- The index law for zero index: $x^0 = 1$

Exercise 2.1.1 Simplify each of these expressions using Index laws:

1. $a^2 \times a^3 \times a^4 \div a^6 =$ _____

2. $(a^3)^2 \times a^3 \times b^4 =$ _____

3. $y^{12} \times x^4 \div (y^2)^3 =$ _____

4. $56m^8 \div 8m^4 =$ _____

5. $(3m^2)^3 \div 9m^5 =$ _____

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

7. $(a^{\frac{1}{2}})^3 =$ _____

8. $(k^4 \times k^3 \div k^2)^2 =$ _____

9. $3^5 \times 3^2 \div 3^6 =$ _____

10. $(6^{2a})^{3a} =$ _____

11. $(3^x)^{y+z} =$ _____

12. $(a^{m-n})^k =$ _____

2.1.1 The zero index**Exercise 2.1.2 Evaluate:**

1. $10^\circ =$ _____

2. $(-5)^\circ =$ _____

3. $(2pq)^\circ =$ _____

4. $(x^2y)^\circ =$ _____

5. $m^2np^\circ =$ _____

6. $2p^\circ \times 3q^\circ \times 2 =$ _____

7. $(2x^2)^\circ + (3y)^\circ - z^\circ =$ _____

8. $5^\circ + (5a)^\circ + (5b)^\circ =$ _____

9. $(5x)^\circ + 5x^\circ =$ _____

10. $2x^\circ \times (\frac{1}{x})^\circ \times (8x)^\circ =$ _____

11. $(3x^2 \times 4x^3)^\circ =$ _____

12. $3p^\circ \times 7q^\circ \times 3 =$ _____

13. $8^\circ + (8a)^\circ + 8a^\circ =$ _____

14. $5x^\circ + 25 \div 5y^\circ =$ _____

2.1.2 The negative index

$$a^{-1} = \frac{1}{a} \quad \text{and} \quad a^{-n} = \frac{1}{a^n}$$

Example 2.1.1 Express each of these as a fraction in simplest form:

1. $5^{-1} = \frac{1}{5}$

2. $5^{-2} = \frac{1}{5^2} = \frac{1}{25}$

3. $x^{-1} = \frac{1}{x}$

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

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

6. $(2x)^{-3} = \frac{1}{(2x)^3} = \frac{1}{8x^3}$

7. $(2x^2)^{-3} = \frac{1}{(2x^2)^3} = \frac{1}{8x^6}$

8. $2x^{-2} = \frac{2}{x^2}$

Exercise 2.1.3 Express each of these as a fraction in its simplest form:

1. $7^{-1} =$ _____

2. $12^{-2} =$ _____

3. $3^{-5} =$ _____

4. $y^{-1} =$ _____

5. $x^{-3} =$ _____

6. $(5x)^{-1} =$ _____

7. $(5x)^{-3} =$ _____

8. $(5x^2)^{-3} =$ _____

9. $(5x^2y^3)^{-3} =$ _____

10. $2n^{-6} =$ _____

Exercise 2.1.4 Consolidation

1. Find the value of n in each of these:

(a) $\frac{1}{5} = 5^n =$ _____

(b) $\frac{1}{125} = 5^n =$ _____

(c) $\frac{1}{64} = 2^n =$ _____

(d) $\frac{1}{81} = 3^n =$ _____

(e) $\frac{1}{49} = 7^n =$ _____

2. Express each of these without negative indices:

(a) $(11p)^{-2} =$ _____

(b) $(7x^3)^{-2} =$ _____

(c) $(12x^6)^{-2} =$ _____

(d) $(a^2b^3)^{-3} =$ _____

(e) $(3a^2b^3c^4)^{-4} =$ _____

3. Evaluate the following expressions without using a calculator:

(a) $5^{-1} + 5^0 + 5^1 + 5^2 =$ _____

(b) $2^{-1} \times 100 =$ _____

(c) $3^{-2} \div \frac{1}{36} =$ _____

(d) $2^{-5} \div 4^{-2} =$ _____

(e) $2^{-5} \times 4^{-2} =$ _____

Exercise 2.1.5 Further applications

1. Express each of these in its simplest form without negative indices:

(a) $\left(\frac{1}{3}\right)^{-1} =$ _____

(b) $\left(\frac{2}{3}\right)^{-1} =$ _____

(c) $\left(\frac{2}{3}\right)^{-2} =$ _____

(d) $\left(\frac{4}{5}\right)^{-2} =$ _____

(e) $\left(\frac{3}{2}\right)^{-4} =$ _____

(f) $\left(\frac{10}{3}\right)^{-4} =$ _____

(g) $\left(3\frac{1}{3}\right)^{-1} =$ _____

(h) $\left(2\frac{1}{4}\right)^{-2} =$ _____

(i) $\left(2\frac{2}{3}\right)^{-4} =$ _____

2. Express each of these in its simplest form without grouping symbols or negative indices:

(a) $\left(\frac{x}{5}\right)^{-1} =$ _____

(b) $\left(\frac{5}{x}\right)^{-1} =$ _____

(c) $\left(\frac{3}{m}\right)^{-4} =$ _____

(d) $\left(\frac{2x}{5}\right)^{-2} =$ _____

(e) $\left(\frac{x^2}{5}\right)^{-1} =$ _____

(f) $\left(\frac{xy}{5}\right)^{-5} =$ _____

(g) $\left(\frac{3x}{4y}\right)^{-3} =$ _____

(h) $\left(\frac{2a^2b}{3c}\right)^{-2} =$ _____

2.1.3 The product and quotients with negative indices**Example 2.1.2** Express each of these products as a fraction without negative indices:

1. $ab^{-1} = a \times \frac{1}{b} = \frac{a}{b}$

2. $a^{-1}b^{-1} = \frac{1}{a} \times \frac{1}{b} = \frac{1}{ab}$

3. $2a^2b^{-2}c^{-3} = 2a^2 \times \frac{1}{b^2} \times \frac{1}{c^3} = \frac{2a}{b^2c^3}$

Example 2.1.3 Express each fraction as a product containing negative indices:

1. $\frac{x^2}{y^3} = x^2 \times \frac{1}{y^3} = a^2y^{-3}$

2. $\frac{1}{x^2y^3} = \frac{1}{x^2} \times \frac{1}{y^3} = x^{-2}y^{-3}$

3. $\frac{2x^2}{y^3} = 2x^2 \times \frac{1}{y^3} = 2x^2y^{-3}$

Exercise 2.1.6 Express each of these products as a fraction without negative indices:

1. $2x^2y^{-3}z =$ _____

2. $\frac{2}{5}x^{-3} =$ _____

3. $5m^{-1}n^{-2} =$ _____

4. $2a^3b^{-6} =$ _____

Exercise 2.1.7 Express each fraction as a product containing negative indices:

1. $\frac{a^2}{b^5} =$ _____

2. $\frac{1}{5x^3} =$ _____

3. $\frac{1}{2x^2y^5} =$ _____

4. $\frac{3}{8q^4} =$ _____

2.1.4 Miscellaneous questions on the index laws**Exercise 2.1.8 Express each of these as a fraction in its simplest form without negative indices:**

1. $9^{-2} =$ _____

2. $4^{-4} =$ _____

3. $(3x^3y^4z^5)^{-3} =$ _____

4. $\frac{1}{8}y^2z^{-6} =$ _____

5. $5x^{-4}y^3 =$ _____

6. $5m^2n^{-3}p^{-2} =$ _____

Exercise 2.1.9 Express each fraction as a product containing negative indices:

1. $\frac{p^2q^6}{r^3} =$ _____

2. $\frac{a^2b}{c^5} =$ _____

3. $\frac{1}{e^2f^3g^4} =$ _____

4. $\frac{2p^2}{3q^3} =$ _____

5. $\frac{5}{6gh^3} =$ _____

6. $\frac{7u^3}{12w^9} =$ _____

Exercise 2.1.10 Simplify each of the following expressions:

1. $m^6 \times m^{-3} \times m^2 =$ _____

2. $n^{-2} \times n^{-5} =$ _____

3. $5x^{-2} \times x^5 =$ _____

4. $(2a^{-5})^2 =$ _____

5. $(2x^2y^3)^{-2} =$ _____

6. $(3x^{-3})^{-2} =$ _____

2.2 Math challenge

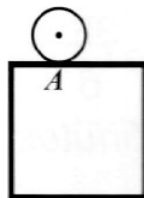
Exercise 2.2.1

1. 4 chefs require 10 minutes to prepare 20 desserts. At this rate, how many chefs are needed to prepare 75 desserts in 15 minutes?

2. Suppose P and Q both represent prime numbers such that $5 \times P + 7 \times Q = 109$. Find the value of the prime P .

3. There are 25 students on the Geoville maths Team. 11 play chess, 15 play tennis, while 3 play neither chess nor tennis. How many students play chess, but not tennis?

4. A circle rolls once, without slipping, along the outside of a square with sides of length 8 cm, and returns to its starting point at A . The radius of the circle is 2 cm. Find the distance of the centre of the circle traveled, correct to 2 decimal places.



2.3 Miscellaneous exercise**Exercise 2.3.1 Simplify the following and express your answers in positive index form:**

1. $\frac{32a^6b^4}{6a^2b \times (4ab)^2}$

2. $(3x^2)^2 \times \left(\frac{x^2}{3y}\right)^{-3}$

3. $8(x^{-2}y^3)^4 \times (2xy^2)^{-2}$

4. $\frac{4x^{-1}y}{(x^2y)(2x^{-3}y)^3}$

5. $\frac{(-2a^3)^3}{(2a^{-2})^{-3}}$

6. $\frac{2a^{-7}b^2}{b^{-4}c^{-2}} \times \frac{ab^{-1}}{3} \div \frac{(8ab)^{-1}}{c}$

Exercise 2.3.2 Find the value of x in each of the following:

1. $27^x = 9^{x-1}$

2. $3x^{-4} = \frac{1}{27}$

3. $\left(\frac{3}{2}\right)^x \times \left(\frac{4}{9}\right)^{-x} = 3\frac{3}{8}$

4. $(3x)^{-2} = 9$

5. $\left(\frac{4}{9}\right)^{-x} = \frac{3}{2}$

6. $\left(\frac{a}{b}\right)^{2x} \times \left(\frac{b}{a}\right)^{1-x} = \left(\frac{a}{b}\right)^3$
