Laws of Indices - Worksheet

Skill

Group A - Multiplying powers

Simplify the following. Express your answer in index form:

1) $b^2 \times b^3$

2) $b^9 \times b^8$

3) $b^{-9} \times b^5$

4) $b^{-8} \times b^{-9}$

5) $b^8 \times b^0$

6) $2b^3 \times 3b^2$

7) $9b^4 \times 6b^4$

8) $8b^{2a} \times 4b^{4a}$

9) $b^{\frac{1}{2}} \times b^{\frac{2}{3}}$

Group B - Dividing powers

Simplify the following. Express your answer in index form:

1) $m^7 \div m^2$

2) $m^0 \div m^7$

3) $m^3 \div m^9$

4) $m^{-2} \div m^{-9}$

5) $m^5 \div m^5$

6) $16m^6 \div 4m^5$

7) $a^6m^2 \div a^6m^3$

8) $m^{\frac{3}{4}} \div m^{\frac{1}{7}}$

9) $(-9m)^3 \div (9m)^2$

Group C - Brackets

Simplify the following. Express your answer in index form:

1) $(y^2)^3$

2) $(y^6)^{-7}$

3) $(2y^2)^4$

4) $(4y^{-3})^2$

5) $(y^3m^5)^2$

6) $(7y^{-2})^{-2}$

7) $(y^{-4}x^3)^8$

8) $(x^6y^2)^{\frac{1}{2}}$

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

Laws of Indices - Worksheet

Group D - Negative and fractional indices

Find the value of the following. Express your answer as an integer or fraction:

1) 3^{-1}

2) $\left(\frac{4}{5}\right)^{-1}$

3) $16^{\frac{1}{2}}$

4) $64^{\frac{1}{2}}$

5) $8^{\frac{1}{3}}$

6) $36^{-\frac{1}{2}}$

7) $125^{\frac{2}{3}}$

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

9) $27^{-\frac{2}{3}}$

Group E - Combining power laws

Simplify fully. Express your answer in index form:

1) $x^2 \times x^3 \div x^2$

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

3) $(x^2)^3 \div (x^{-2})^3$

4) $8x^2 \times 4x^3 \div 2x^2$

5) $27x^2 \times x^{-1} \div 9x^4$

6) $(x^2y^6)^7 \times (xy^2)^4$

7) $(2x^2y^3)^2 \times (x^2y^4)^2$

8) $(2x^2y^3)^3 \div (2xy^2)^2$

9) $(-3x^5y^3)^3 \div (-3xy^2)^2$

Laws of Indices - Worksheet

Applied

1) Create at least 2 different expressions which you can simplify to get the answers below. Each expression must use at least two different index laws.

(a) x^2

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

(c) $-2x^2y^{-3}$

2) Use the laws of indices to calculate the value of y in the equations below.

(a) $x^y \times x^3 \div x^2 = x^9$

(b) $5^y \times 5^3 \div 5^4 = 125$

(c) $25^y \times 5^8 = 5^{22}$

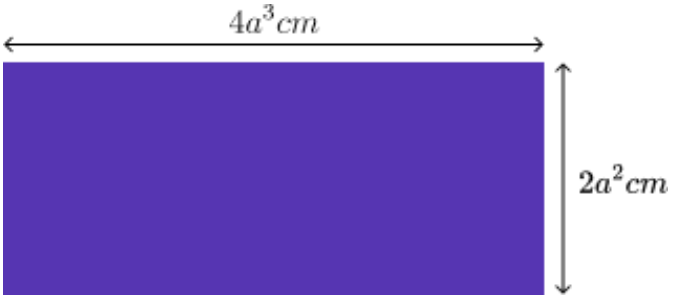
3) Without using a calculator, simplify the expressions below to find the missing power.

(a) $11^4 \times 121^2 = 11^{\square}$

(b) $(16^3 \times 2^4) \div 2^3 = 2^{\square}$

(c) $125^2 \times 25^4 \times 5^8 = 5^{\square}$

4) Write a simplified expression for the area of the rectangle below:



Laws of Indices - Exam Questions

1) Simplify fully:

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

.....

(1)

(b) $\frac{p^7}{p^3}$

.....

(1)

(c) $(2x^4)^2$

.....

(2)

(4 marks)

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2) Simplify:

(a) $6h^3m^6 \times 4h^4m^5$

.....

(2)

(b) $\frac{12x^5y^7}{3x^2y}$

.....

(2)

(4 marks)

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3) Work out the value of:

(a) 5^0

.....

(1)

(b) 5^{-3}

.....

(2)

(c) $16^{\frac{3}{2}}$

.....

(2)

(5 marks)

Laws of Indices - Exam Questions

4) Find the value of y:

$$7^{y} \times 7^{3} = 7^{4} \times 7^{5}$$

.....

(2 marks)

Laws of Indices - Answers

	Question	Answer
	Skill Questions	
Group A	Simplify the following. Express your answer in index form: **1)** $b^2 \times b^3$ **2)** $b^9 \times b^8$ **3)** $b^{-9} \times b^5$ **4)** $b^{-8} \times b^{-9}$ **5)** $b^8 \times b^0$ **6)** $2b^3 \times 3b^2$ **7)** $9b^4 \times 6b^4$ **8)** $8b^{2a} \times 4b^{4a}$ **9)** $b^{\frac{1}{2}} \times b^{\frac{2}{3}}$	 **1)** b^5 **2)** b^{17} **3)** b^{-4} **4)** b^{-17} **5)** b^8 **6)** $6b^5$ **7)** $54b^8$ **8)** $32b^{6a}$ **9)** $b^{\frac{7}{6}}$
Group B	Simplify the following. Express your answer in index form: **1)** $m^7 \div m^2$ **2)** $m^0 \div m^7$ **3)** $m^3 \div m^9$ **4)** $m^{-2} \div m^{-9}$ **5)** $m^5 \div m^5$ **6)** $16m^6 \div 4m^5$ **7)** $a^6m^2 \div a^6m^3$ **8)** $m^{\frac{3}{4}} \div m^{\frac{1}{7}}$ **9)** $(-9m)^3 \div (9m)^2$	 **1)** m^5 **2)** m^{-7} **3)** m^{-6} **4)** m^7 **5)** 1 **6)** $4m$ **7)** m^{-1} **8)** $m^{\frac{17}{28}}$ **9)** $-9m$

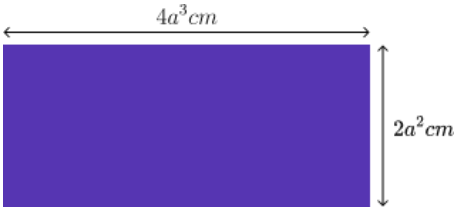
Laws of Indices - Answers

Group C	Simplify the following. Express your answer in index form: **1)** $(y^2)^3$ **2)** $(y^6)^{-7}$ **3)** $(2y^2)^4$ **4)** $(4y^{-3})^2$ **5)** $(y^3m^5)^2$ **6)** $(7y^{-2})^{-2}$ **7)** $(y^{-4}x^3)^8$ **8)** $(x^6y^2)^{\frac{1}{2}}$ **9)** $(-x^6y^{\frac{2}{3}})^{\frac{1}{2}}$	**1)** y^6 **2)** y^{-42} **3)** $16y^8$ **4)** $16y^{-6}$ **5)** y^6m^{10} **6)** $\frac{y^4}{49}$ **7)** $y^{-32}x^{24}$ **or** $\frac{x^{24}}{y^{32}}$ **8)** x^3y **9)** $-x^3y^{\frac{1}{3}}$
Group D	Find the value of the following. Express your answer as an integer or fraction: **1)** 3^{-1} **2)** $(\frac{4}{5})^{-1}$ **3)** $16^{\frac{1}{2}}$ **4)** $64^{\frac{1}{2}}$ **5)** $8^{\frac{1}{3}}$ **6)** $36^{-\frac{1}{2}}$ **7)** $125^{\frac{2}{3}}$ **8)** $8^{-\frac{2}{3}}$ **9)** $27^{-\frac{2}{3}}$	**1)** $\frac{1}{3}$ **2)** $\frac{5}{4}$ **3)** 4 **4)** 8 **5)** 2 **6)** $\frac{1}{6}$ **7)** 25 **8)** $\frac{1}{4}$ **9)** $\frac{1}{9}$

Laws of Indices - Answers

Group E	Simplify fully. Express your answer in index form:	
	1) $x^2 \times x^3 \div x^2$	**1)** x^3
	2) $(x^2)^3 \times (x^2)^3$	**2)** x^{12}
	3) $(x^2)^3 \div (x^{-2})^3$	**3)** x^{12}
	4) $8x^2 \times 4x^3 \div 2x^2$	**4)** $16x^3$
	5) $27x^2 \times x^{-1} \div 9x^4$	**5)** $3x^{-3}$
	6) $(x^2y^6)^7 \times (xy^2)^4$	**6)** $x^{18}y^{50}$
	7) $(2x^2y^3)^2 \times (x^2y^4)^2$	**7)** $4x^8y^{14}$
	8) $(2x^2y^3)^3 \div (2xy^2)^2$	**8)** $2x^4y^5$
	9) $(-3x^5y^3)^3 \div (-3xy^2)^2$	**9)** $-3x^{13}y^5$

Laws of Indices - Answers

	Question	Answer
	Applied Questions	
1)	Create at least 2 different expressions which you can simplify to get the answers below. Each expression must use at least two different index laws. **(a)** x^2 **(b)** $2x^2y^3$ **(c)** $-2x^2y^{-3}$	**(a)** Example solution: $x^2 \times x^3 \div x^3$ **(b)** Example solution: $3x \times 4x^3y^4 \div 6x^2y$ **(c)** Example solution: $-6x^4y \times 3y^2 \div 9x^2y^6$
2)	Use the laws of indices to calculate the value of y in the equations below: **(a)** $x^y \times x^3 \div x^2 = x^9$ **(b)** $5^y \times 5^3 \div 5^4 = 125$ **(c)** $25^y \times 5^8 = 5^{22}$	**(a)** $y = 8$ **(b)** $y = 4$ **(c)** $y = 7$
3)	Without using a calculator, simplify the expressions below to find the missing power: **(a)** $11^4 \times 121^2 = 11^{\square}$ **(b)** $(16^3 \times 2^4) \div 2^3 = 2^{\square}$ **(c)** $125^2 \times 25^4 \times 5^8 = 5^{\square}$	**(a)** 8 **(b)** 13 **(c)** 22
4)	Write a simplified expression for the area of the rectangle below: 	$8a^5cm^2$

Laws of Indices - Mark Scheme

	Question	Answer	
	Exam Questions		
1)	Simplify fully:		
(a)	$x^2 \times x^3$	**(a)** x^5	**(1)**
(b)	$\frac{p^7}{p^3}$	**(b)** p^4	**(1)**
(c)	$(2x^4)^2$	**(c)** 4 **or** x^8 $4x^8$	**(1)** **(1)**
2)	Simplify:		
(a)	$6h^3m^6 \times 4h^4m^5$	**(a)** h^7 **or** m^{11} **seen** $24h^7m^{11}$	**(1)** **(1)**
(b)	$\frac{12x^5y^7}{3x^2y}$	**(b)** x^3 **or** y^6 **seen** $4x^3y^6$	**(1)** **(1)**
3)	Work out the value of:		
(a)	5^0	**(a)** 1	**(1)**
(b)	5^{-3}	**(b)** 125 **or** $\frac{1}{5^3}$ **seen** $\frac{1}{125}$	**(1)** **(1)**
(c)	$16^{\frac{3}{2}}$	**(c)** $\sqrt{}$ seen or 4 or 4^3 64	**(1)** **(1)**
4)	Find the value of y: $7^y \times 7^3 = 7^4 \times 7^5$	7^9 **or** 7^6 **or** $7^{y+3} = 7^9$ **or** $y + 3 = 9$ **seen** $y = 6$	**(1)** **(1)**