Exponents & Substitution

October-30-16
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Mathematics 9
Exponents
Exponents & Substitution

A. Exponents & Rules for Substitution

Sometimes you will be told what the value of each variable is worth. In this case, in addition to simplifying using your exponent laws, you will also have to substitute the assigned values into the question in order to evaluate to a final number answer.

1. Solve the following if $x = 2$.

To Solve
a) Apply all exponent laws first
b) Substitute the value into the expression and evaluate.

a) $(3x^{-2})(5x^{-1})$

$= 15x^{-2+-1}$

$= 15x^{-3}$

$= \frac{15}{x^3}$

$= \frac{15}{(2)^3} = \boxed{\frac{15}{8} \text{ or } 1\frac{7}{8}}$

b) $\frac{9x^1}{3x^{-4}}$

$= 3x^{1--4} = 3x^{1+4}$

$= 3x^5$

$= 3(2)^5$

$= 3(32) = \boxed{96}$

32
x 3
96

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

$= \frac{2^2x^2}{3^2x^{-1\cdot 2}} = \frac{4x^2}{9x^{-2}}$

2
16
x 4
64

$= \frac{4x^{2--2}}{9} = \frac{4x^{2+2}}{9}$

$= \frac{4x^4}{9} = \frac{4(2)^4}{9} = \frac{4(16)}{9} = \boxed{\frac{64}{9} \text{ or } 7\frac{1}{9}}$

2. Solve the following if $x = 3$ and $y = -2$.

a) $\left(3x^2y^{-1}\right)^{-2}$

$= 3^{-2}\, x^{2\cdot-2}\, y^{-1\cdot-2} = 3^{-2}\, x^{-4}\, y^{2}$

$= \frac{y^2}{3^2 x^4} = \frac{y^2}{9x^4}$

$= \frac{(-2)^2}{9(3)^4} = \frac{4}{9(81)} = \boxed{\frac{4}{729}}$

81 × 9 / 729

b) $\frac{\left(x^2y\right)^2}{\left(xy^{-1}\right)^3}$

$= \frac{x^{2\cdot2}\, y^{2}}{x^3\, y^{-1\cdot3}} = \frac{x^4\, y^2}{x^3\, y^{-3}}$

$= x^{4-3}\, y^{2--3} = x^{4-3}\, y^{2+3}$

$= xy^5$

$= (3)(-2)^5 = 3(-32) = \boxed{-96}$

32 × 3 / −96

c) $\frac{\left(-4x^2y^3\right)\left(6x^{-1}y^{-1}\right)}{\left(2x^{-2}y\right)(3xy)}$

$= \frac{-24\, x^{2+-1}\, y^{3+-1}}{6\, x^{-2+1}\, y^{1+1}} = \frac{-24xy^2}{6x^{-1}y^2}$

$= -4\, x^{1--1}\, y^{2-2} = -4x^{1+1}\, y^{2-2}$

$= -4x^2y^0 = -4x^2(1)$

$= -4x^2$

$= -4(3)^2 = -4(9) = \boxed{-36}$

Assignment: Exponents & Substitution Assignment

Name:_____

Exponents & Substitution Assignment

A. Evaluate following if $x = 2$ and $y = 3$.

1. $\left(x^2 y^{-2}\right)\left(xy^{-1}\right)$

2. $\left(3x^2 y^{-1}\right)\left(2xy^{-1}\right)$

3. $\dfrac{x^5 y^4}{xy^3}$

4. $\dfrac{2x^{-1} y^2}{4xy^2}$

5. $\dfrac{10x^2 y}{5x^4 y^{-2}}$

6. $\dfrac{12xy^{-1}}{18x^{-2} y}$

7. $\left(x^{-1} y\right)^2$

8. $\left(-5x^{-1} y^{-1}\right)^2$

B. Evaluate following if $x = 2$ and $y = -1$.

9. $\dfrac{6x^2y^{-2}}{8x^4y^{-4}}$

10. $\left(3xy^{-2}\right)^{-2}$

11. $\left(x^3y^3\right)^{-1}\left(x^3y^2\right)^2$

12. $\left(x^2y^{-2}\right)\left(xy^{-3}\right)$

13. $\dfrac{\left(x^2y\right)\left(x^3y\right)}{(xy)^2}$

14. $\dfrac{\left(x^4y^6\right)^{\frac{3}{2}}}{\left(x^3y\right)^3}$

15. $\dfrac{\left(3x^{-1}y^3\right)^3}{\left(2x^{-1}y^3\right)^2}$

16. $\left(xy^2\right)^{-3}\left(x^2y^2\right)^2$

Answers

1) $\frac{8}{27}$ 2) $\frac{48}{9}$ 3) 48 4) $\frac{1}{8}$

5) $\frac{27}{2}$ 6) $\frac{16}{27}$ 7) $\frac{9}{4}$ 8) $\frac{25}{36}$

9) $\frac{3}{16}$ 10) $\frac{1}{36}$ 11) -8 12) -8

13) 8 14) $\frac{1}{8}$ 15) $\frac{-27}{8}$ 16) 2