Math 10C: Exponents Unit

Practice Test

(Laws of Exponents · Negative/Zero Exponents · Rational Exponents & Radicals · Scientific Notation)

Instructions. Show work in the space beside each question. Calculators permitted unless instructed otherwise. For **Numerical Response**, print your answer in the boxes from left to right (no commas or units).

Multiple Choice (1–10)

1) The base and exponent in $(-2)^4$ are respectively

A. 2 and -4

B. 2 and 4

C. -2 and -4

D. -2 and 4

2) The coefficient in the expression $-\dfrac{3x^5}{2}$ is

A. -3

B. $-\dfrac{3}{2}$

C. $\dfrac{3}{2}$

D. -5

3) a^0 is equivalent to

A. 0

B. 1

C. $-a$

D. -1

4) Which of the following simplify to a^6?

I. $a^3 \cdot a^3$ II. $(a^2)^3$ III. $a^{12} \div a^6$ IV. $a^8 \cdot a^{-2}$

A. I only

B. I and II only

C. I, II and III only

D. I, II, III and IV

5) $3a^5 \cdot 2a^{-2}$ simplifies to

A. $6a^7$

B. $6a^3$

C. $-6a^3$

D. $5a^3$

6) $\dfrac{6x^3}{2x^{-4}}$ can be simplified to

A. $4x^{-7}$

B. $3x^7$

C. $4x^7$

D. $3x^{-1}$

7) $5a^{-2}$ is equivalent to

A. $5a^2$

B. $a^{-2}/5$

C. $\dfrac{1}{5a^2}$

D. $\dfrac{5}{a^2}$

8) $\left(x^{\frac{1}{2}}y^{-\frac{3}{4}}\right)^4$ equals

A. x^2y^3

B. $x^{-2}y^3$

C. $\dfrac{x^2}{y^3}$

D. $\dfrac{x^4}{y^3}$

9) $4^{-\frac{3}{2}}$ equals

A. 8

B. $\dfrac{1}{8}$

C. $\dfrac{1}{16}$

D. 16

10) Expressed in radical form, $x^{\frac{5}{3}}$ is

A. $\sqrt{x^5}$

B. $\sqrt[3]{x^5}$

C. $\sqrt[5]{x^3}$

D. $x\sqrt[3]{x^2}$

Numerical Response (11–14)

Record your answer in the boxes.

11) Use the information:

$$(3^a)^2 = 3^8, \qquad (x^3)^b = x^{15}, \qquad 5^c \div 5^2 = 5^7, \qquad t^4 \cdot t^d = t^{11}.$$

Write a in the first box, b in the second, c in the third, and d in the fourth. ☐☐☐☐

12) $\dfrac{8a^5b^{-2}}{2a^{-1}b^3}$ can be written as $a^x b^y$. Enter x then y. ☐☐☐☐

13) Write 0.000376 in scientific notation as $a \times 10^n$ and then record $a + n$. ☐☐☐☐☐☐

14) $(-2p^3q^{-1})(-3p^2q^4)(4p^{-5}q^2) = a\,p^x q^y$ with $a > 0$. Record $x + y$. ☐☐☐

Multiple Choice (15–18)

15) Which statement is true (assume $a > 0$)?

A. $a^{-\frac{1}{2}} < 0$

B. $\dfrac{1}{a^{3/2}} < 0$

C. $(-a)^{2/3} < 0$

D. $-a^{2/3} < 0$

16) Expressed in radical form, $x^{\frac{3}{2}}$ is

A. $\sqrt[3]{x^2}$

B. $\sqrt{x^3}$

C. $\dfrac{1}{\sqrt{x^3}}$

D. $x^2\sqrt{x}$

17) $(2.5 \times 10^{-2})(4.0 \times 10^3)$ equals

A. 1.0×10^1

B. 1.0×10^2

C. 10×10^2

D. 0.10×10^3

18) Solve for x: $5^{\,2x+1} = 125$.

A. 0

B. 1

C. 2

D. 3

Written Response — 5 marks

Show clear steps and use exponent laws.

1. A sheet of paper is 9.0×10^{-5} m thick. How many sheets are needed to make a stack 2.4 m high? Round to the nearest thousand. (2 marks)

2. Compare magnitudes using scientific notation.
   (a) Estimate the total number of hairs on all people on Earth if the population is 8.0×10^{9} and the average person has 1.2×10^{5} hairs. Give scientific notation (coefficient to the nearest hundredth). (2 marks)

   (b) The planet Mercury has mass 3.30×10^{23} kg and an electron has mass 9.11×10^{-31} kg. Approximately how many electrons have the same mass as Mercury? Give scientific notation (coefficient to the nearest hundredth). (1 mark)

Answer Key

1) D 10) B
2) B 11) $\boxed{4}\ \boxed{5}\ \boxed{9}\ \boxed{7}$
3) B 12) $\boxed{6}\ \boxed{-5}$
4) D 13) $\boxed{-0.24}$
5) B 14) $\boxed{5}$
6) B 15) D
7) D 16) B
8) C 17) B
9) B 18) B

Notes/Justification

- 2) Coefficient is the numeric multiplier: $-\frac{3}{2}$.
- 4) I: a^{3+3}; II: $(a^2)^3 = a^6$; III: a^{12-6}; IV: a^{8-2}.
- 5) $3 \cdot 2 = 6$, $a^{5-2} = a^3$.
- 6) $\dfrac{6}{2} = 3$, $x^{3-(-4)} = x^7$.
- 7) a^{-2} moves to denominator: $5/a^2$.
- 8) $(x^{1/2})^4 = x^2$ and $(y^{-3/4})^4 = y^{-3}$.
- 9) $4^{-3/2} = (\sqrt{4})^{-3} = 2^{-3} = 1/8$.
- 10) $x^{5/3} = \sqrt[3]{x^5}$.
- 11) Exponents: $2a = 8 \Rightarrow a = 4$; $(x^3)^b = x^{3b} = x^{15} \Rightarrow b = 5$; $5^{c-2} = 5^7 \Rightarrow c = 9$; $4 + d = 11 \Rightarrow d = 7$.
- 12) $8/2 = 4$; $a^{5-(-1)} = a^6$; $b^{-2-3} = b^{-5}$ so $x = 6,\ y = -5$.
- 13) $0.000376 = 3.76 \times 10^{-4} \Rightarrow a + n = 3.76 + (-4) = -0.24$.
- 14) Coefficient $(-2)(-3)(4) = 24$; p exponent $3 + 2 - 5 = 0$; q exponent $-1 + 4 + 2 = 5$; $x + y = 5$.
- 15) For $a > 0$, $a^{2/3} > 0$ so $-a^{2/3} < 0$; others are positive.
- 16) $x^{3/2} = \sqrt{x^3}$.
- 17) Multiply coefficients and add exponents: $(2.5)(4.0) = 10.0$ and $10^{-2+3} = 10^1$, giving 1.0×10^2.
- 18) $125 = 5^3$, so $2x + 1 = 3 \Rightarrow x = 1$.
- WR1) $\dfrac{2.4}{9.0 \times 10^{-5}} \approx 2.667 \times 10^4 \approx \mathbf{26\,700}$ sheets.
- WR2(a) $(8.0 \times 10^9)(1.2 \times 10^5) = 9.6 \times 10^{14} \approx \mathbf{9.60 \times 10^{14}}$ hairs.
- WR2(b) $\dfrac{3.30 \times 10^{23}}{9.11 \times 10^{-31}} = 3.62 \times 10^{53} \approx \mathbf{3.62 \times 10^{53}}$ electrons.