Name: _____ Date: _____ Score: _____ / 10

ESCONDIDO ADULT SCHOOL • HiSET MATHEMATICS PREPARATION

Exponents & Roots 2

CA HiSET Standards: NSQ.2 & ALG.3 | 10 Word Problems

Directions: Solve each word problem. Show all work in the box provided. Write your final answer on the answer line. Include units where applicable.

1

Estimating Square Roots

The square root of 30 is between which two consecutive whole numbers?

Answer all 4 steps below:

(a) Identify the two perfect squares that 30 falls between.

(b) Write the inequality: _____ < √30 < _____

(c) Estimate √30 to the nearest tenth.

(d) Is √30 rational or irrational? Explain.

Show your work:

2

Estimating Square Roots

The square root of 85 is between which two consecutive whole numbers?

Answer all 4 steps below:

(a) Identify the two perfect squares that 85 falls between.

(b) Write the inequality: _____ < √85 < _____

(c) Estimate √85 to the nearest tenth.

(d) Is √81 rational or irrational? How is it different from √85?

Show your work:

3

Estimating Cube Roots

The cube root of 30 is between which two consecutive whole numbers?

Answer all 4 steps below:

(a) Evaluate 3^3 and 4^3.

(b) Write the inequality: _____ < $\sqrt[3]{30}$ < _____

(c) Estimate $\sqrt[3]{30}$ to the nearest tenth.

(d) Rewrite $\sqrt[3]{30}$ as an exponent.

Show your work:

4

Estimating Higher-Order Roots

The 4th root of 90 is between which two consecutive whole numbers?

Answer all 4 steps below:

(a) Evaluate 3^4 and 4^4.

(b) Write the inequality: _____ < $\sqrt[4]{90}$ < _____

(c) Estimate $\sqrt[4]{90}$ to the nearest tenth.

(d) Rewrite $\sqrt[4]{90}$ as an exponent.

Show your work:

5

Multiplying Expressions with Exponents (Product Rule)

Simplify each expression using the Product Rule of Exponents ($a^m \times a^n = a^{m+n}$).

Answer all 4 steps below:

(a) $y^3 \times y^6 =$

(b) $2^3 \times 2^4 =$ (evaluate to a single number)

(c) $10^2 \times 10^3 =$ (evaluate to a single number)

(d) $(2x^3y)(7x^2y^4) =$ (simplify completely)

Show your work:

6

Dividing Expressions with Exponents (Quotient Rule)

Simplify each expression using the Quotient Rule of Exponents ($a^m \div a^n = a^{m-n}$).

Answer all 4 steps below:

(a) $a^9 \div a^4 =$

(b) $3^7 \div 3^4 =$ (evaluate to a single number)

(c) $20x^6 \div 5x^2 =$ (simplify completely)

(d) Use the Quotient Rule to simplify $7^3 \div 7^3$. What does this show about 7^0?

Show your work:

7

Raising a Power to a Power (Power Rule)

Simplify each expression using the Power Rule of Exponents ($(a^m)^n = a^{m \times n}$).

Answer all 4 steps below:

(a) $(x^3)^4$ =

(b) $(2^2)^3$ = (evaluate to a single number)

(c) $(3a^2)^3$ = (simplify completely)

(d) $(x^2y^5)^2$ = (simplify completely)

Show your work:

8

Zero and Negative Exponents

Use the rules $a^0 = 1$ and $a^{-n} = 1/a^n$ (for any nonzero a) to evaluate or simplify.

Answer all 4 steps below:

(a) Evaluate 5^{-2} as a fraction.

(b) Evaluate 2^{-3} as a fraction.

(c) Rewrite x^{-4} using a positive exponent.

(d) Evaluate $4^0 + 4^{-1}$.

Show your work:

9

Rational Exponents & Radical Equivalence

Use properties of rational exponents to evaluate or simplify. Recall: $a^{m/n} = (\sqrt[n]{a})^m$

Answer all 4 steps below:

(a) Evaluate $64^{1/2}$ (the square root of 64)

(b) Evaluate $8^{2/3}$ [Hint: find the cube root of 8 first, then square it]

(c) Rewrite $\sqrt[3]{(x^2)}$ (the cube root of x squared) using rational exponent notation.

(d) Simplify: $x^{1/2} \times x^{5/2} =$

Show your work:

10

Rational Exponents & Radical Equivalence

Use properties of rational exponents to evaluate or simplify. Recall: $a^{m/n} = (\sqrt[n]{a})^m$

Answer all 4 steps below:

(a) Evaluate $81^{1/4}$ (the 4th root of 81)

(b) Evaluate $32^{3/5}$ [Hint: find the 5th root of 32 first, then cube it]

(c) Rewrite $y^{3/4}$ in radical form.

(d) Simplify: $x^{7/4} \div x^{3/4} =$

Show your work:

ANSWER KEY — Instructor Copy

1 (a) $25 < 30 < 36$, so the perfect squares are 25 (5^2) and 36 (6^2).
(b) $5 < \sqrt{30} < 6$
(c) 30 is a little closer to 25 than to 36, so $\sqrt{30} \approx 5.5$ (calculator: $\sqrt{30} \approx 5.477$)
(d) Irrational — 30 is not a perfect square, so its square root cannot be written as a fraction.

2 (a) $81 < 85 < 100$, so the perfect squares are 81 (9^2) and 100 (10^2).
(b) $9 < \sqrt{85} < 10$
(c) 85 is much closer to 81, so $\sqrt{85} \approx 9.2$ (calculator: $\sqrt{85} \approx 9.220$)
(d) $\sqrt{81} = 9$ is rational because 81 is a perfect square. $\sqrt{85}$ is irrational because 85 is not a perfect square.

3 (a) $3^3 = 27$; $4^3 = 64$
(b) $3 < \sqrt[3]{30} < 4$ (since $27 < 30 < 64$)
(c) 30 is very close to 27, so $\sqrt[3]{30} \approx 3.1$ (calculator: ≈ 3.107)
(d) $30^{1/3}$ — rational exponent form of the cube root.

4 (a) $3^4 = 81$; $4^4 = 256$
(b) $3 < \sqrt[4]{90} < 4$ (since $81 < 90 < 256$)
(c) 90 is very close to 81, so $\sqrt[4]{90} \approx 3.1$ (calculator: ≈ 3.080)
(d) $90^{1/4}$ — rational exponent form of the 4th root.

5 (a) $y^3 \times y^6 = y^{3+6} = y^9$
(b) $2^3 \times 2^4 = 2^{3+4} = 2^7 = 128$
(c) $10^2 \times 10^3 = 10^{2+3} = 10^5 = 100{,}000$
(d) $(2 \times 7)(x^3 \times x^2)(y^1 \times y^4) = 14x^5y^5$

6 (a) $a^9 \div a^4 = a^{9-4} = a^5$
(b) $3^7 \div 3^4 = 3^{7-4} = 3^3 = 27$
(c) $(20 \div 5)(x^6 \div x^2) = 4x^4$
(d) $7^3 \div 7^3 = 7^{3-3} = 7^0$. But any nonzero number divided by itself is 1, so $7^0 = 1$.

7 (a) $(x^3)^4 = x^{3\times4} = x^{12}$
(b) $(2^2)^3 = 2^{2\times3} = 2^6 = 64$
(c) $3^3 \times (a^2)^3 = 27a^6$
(d) $(x^2)^2 \times (y^5)^2 = x^4y^{10}$

8 (a) $5^{-2} = 1/5^2 = 1/25$
(b) $2^{-3} = 1/2^3 = 1/8$
(c) $x^{-4} = 1/x^4$
(d) $4^0 + 4^{-1} = 1 + 1/4 = 5/4$ (or 1¼ or 1.25)

9 (a) $64^{1/2} = \sqrt{64} = 8$
(b) $8^{2/3} = (\sqrt[3]{8})^2 = 2^2 = 4$
(c) $\sqrt[3]{(x^2)} = x^{2/3}$
(d) $x^{1/2} \times x^{5/2} = x^{1/2 + 5/2} = x^{6/2} = x^3$

10 (a) $81^{1/4} = \sqrt[4]{81} = 3$
(b) $32^{3/5} = (\sqrt[5]{32})^3 = 2^3 = 8$
(c) $y^{3/4} = \sqrt[4]{(y^3)}$ (or $(\sqrt[4]{y})^3$)
(d) $x^{7/4} \div x^{3/4} = x^{7/4 - 3/4} = x^{4/4} = x$