

Working with Exponents, Roots and Fractional Powers

Grade 9 – Algebra 1 math · Test Answer Key · Standards: N-RN.A.1, N-RN.A.2

Use this answer key to score the test. Accept equivalent exact forms, such as $4m^5/n^5$ or $4m^5n^{-5}$ only when the question allows negative exponents, and require the correct sign on every coefficient.

Standards: N-RN.A.1, N-RN.A.2 · **Level:** Grade 9 Algebra 1

Question 1 Multiply monomials (2 points)

$6 \times (-2) = -12$. a: $4 + 3 = 7$. b: $1 + 5 = 6$.

$$-12a^7b^6$$

Scoring: 1 point for the coefficient, 1 point for the exponents.

Question 2 Divide monomials (2 points)

$20 \div 5 = 4$; m: $9 - 4 = 5$; n: $3 - 8 = -5$.

$$4m^5n^{-5} = 4m^5 \div n^5.$$

$$4m^5/n^5$$

Scoring: 1 point for the exponents, 1 point for positive exponents.

Question 3 Power of a product (2 points)

$$(-2)^4 = 16, (x^3)^4 = x^{12}, y^4.$$

$$16x^{12}y^4$$

Scoring: 1 point for the coefficient 16, 1 point for the variables.

Question 4 Evaluate rational exponents (2 points)

$$(a) 27^{2/3} = (\sqrt[3]{27})^2 = 3^2 = 9.$$

$$(b) 4^{-3/2} = 1 \div 4^{3/2} = 1 \div (\sqrt{4})^3 = 1 \div 8.$$

(a) 9 (b) $\frac{1}{8}$

Scoring: 1 point per part.

Question 5 Radical and exponent forms (2 points)

(a) $\sqrt[3]{x^7} = x^{7/3}$.

(b) $a^{5/2} = \sqrt{a^5}$, or equivalently $(\sqrt{a})^5$.

(a) $x^{7/3}$ (b) $\sqrt{a^5}$

Scoring: 1 point per part.

Question 6 Simplify square roots (3 points)

(a) $\sqrt{98} = \sqrt{49 \cdot 2} = 7\sqrt{2}$.

(b) $\sqrt{45} = \sqrt{9 \cdot 5} = 3\sqrt{5}$.

(c) $\sqrt{20x^6} = \sqrt{4 \cdot 5 \cdot (x^3)^2} = 2x^3\sqrt{5}$.

(a) $7\sqrt{2}$ (b) $3\sqrt{5}$ (c) $2x^3\sqrt{5}$

Scoring: 1 point per part.

Question 7 Rectangle with radicals (3 points)

(a) $\sqrt{12} = 2\sqrt{3}$ and $\sqrt{27} = 3\sqrt{3}$.

(b) Area = $2\sqrt{3} \cdot 3\sqrt{3} = 6 \cdot 3 = 18 \text{ cm}^2$.

(c) Perimeter = $2(2\sqrt{3} + 3\sqrt{3}) = 10\sqrt{3} \text{ cm}$.

$$\sqrt{12} = 2\sqrt{3} \text{ and } \sqrt{27} = 3\sqrt{3}$$

$$\text{Area} = 2\sqrt{3} \cdot 3\sqrt{3} = 6 \cdot 3 = 18 \text{ cm}^2$$

$$\text{Perimeter} = 2(2\sqrt{3} + 3\sqrt{3}) = 10\sqrt{3} \text{ cm}$$

Worked values for the rectangle.

18 cm²; $10\sqrt{3}$ cm

Scoring: 1 point per part.

Question 8 Radioactive decay (3 points)

(a) $(1/2)^3 = 1/8$, so $A = 10$ g.

(b) $(1/2)^{1/2} = 1/\sqrt{2}$, so $A = 80/\sqrt{2} = 40\sqrt{2} \approx 56.57$ g.

(c) The mass halves every 4 hours: 4 is the half-life.

10 g; $40\sqrt{2} \approx 56.57$ g; half-life 4 hours

Scoring: 1 point per part.

Question 9 Locate a root (1 point)

$7^2 = 49$ and $8^2 = 64$, and $49 < 55 < 64$.

Between 7 and 8

Scoring: 1 point.