Objective: See structure in expressions to solve problems.

Concept

Properties of Rational Exponents		
For all nonzero real numbers a and b and rational numbers m and n		
Words	**Numbers**	**Algebra**
Product of Powers Property: to multiply powers with the same base, add the exponents	$12^{\frac{1}{2}} \cdot 12^{\frac{3}{2}} = 12^{\frac{1}{2}+\frac{3}{2}} = 12^2 = 144$	$a^m \cdot a^n = a^{m+n}$
Quotient of Powers Property: to divide powers with the same base, subtract the exponents	$\frac{125^{\frac{2}{3}}}{125^{\frac{1}{3}}} = 125^{\frac{2}{3}-\frac{1}{3}} = 125^{\frac{1}{3}} = 5$	$\frac{a^m}{a^n} = a^{m-n}$ or $\frac{a^m}{a^n} = \frac{1}{a^{n-m}}$
Power of a Power Property: to raise one power to another, multiply the exponents	$\left(8^{\frac{2}{3}}\right)^3 = 8^{\frac{2}{3}\cdot 3} = 8^2 = 64$	$(a^m)^n = a^{m \cdot n}$
Power of a Product Property: to find a power of a product, distribute the exponent	$(16 \cdot 25)^{\frac{1}{2}} = 16^{\frac{1}{2}} \cdot 25^{\frac{1}{2}} = 4 \cdot 5 = 20$	$(ab)^m = a^m b^m$
Power of a Quotient Property: to find a power of a quotient, distribute the exponent	$\left(\frac{16}{81}\right)^{\frac{1}{4}} = \frac{16^{\frac{1}{4}}}{81^{\frac{1}{4}}} = \frac{2}{3}$	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$

Objective: See structure in expressions to solve problems.

Concept

Properties of Rational Exponents		
For all nonzero real numbers a and b and rational numbers m and n		
Words	**Numbers**	**Algebra**
Negative Exponent Property: moving a power from numerator to denominator or vice versa changes the sign on the exponent	$36^{-\frac{1}{2}} = \frac{1}{36^{\frac{1}{2}}} = \frac{1}{6}$ $\frac{1}{36^{-\frac{1}{2}}} = \frac{36^{\frac{1}{2}}}{1} = \frac{6}{1} = 6$	$a^{-n} = \frac{1}{a^n}$ or $\frac{1}{a^{-n}} = a^n$
Zero Exponent Property: any monomial to a power of 0 is equal to 1	$(3)^0 = 1$	$(a)^0 = 1$

Objective: See structure in expressions to solve problems.

Rewrite the expression in simplest form.

$$\frac{x^5 y^{-1} z}{x^8 y^6 z^{-3}}$$

$$\frac{x^5 z \cdot z^3}{x^8 y^6 y^1} = \frac{z^{1+3}}{x^{8-5} y^{6+1}} = \boxed{\frac{z^4}{x^3 y^7}}$$

Objective: See structure in expressions to solve problems.

$$2^{-3} = ?$$

$$\frac{1}{2^3} = \boxed{\frac{1}{8}}$$

Objective: See structure in expressions to solve problems.

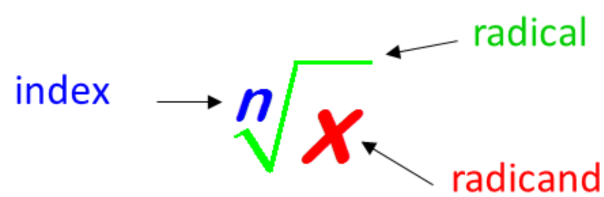
Concept

Rational and irrational numbers expressed in radical form can also be expressed with fractional exponents. When the number has a fractional exponent, it is said to be in rational exponent form.

$$b^{\frac{1}{n}} = \sqrt[n]{b}$$

and

$$b^{\frac{p}{n}} = \sqrt[n]{b^p} \text{ or } b^{\frac{p}{n}} = \left(\sqrt[n]{b}\right)^p$$



Objective: See structure in expressions to solve problems.

Simplify each numerical value as much as possible.

$$\left(\frac{32}{243}\right)^{\frac{2}{5}}$$

$$(512)^{-\frac{2}{3}}$$

$$\frac{\left(\sqrt[5]{32}\right)^2}{\left(\sqrt[5]{243}\right)^2} = \frac{(2)^2}{(3)^2} = \boxed{\frac{4}{9}}$$

$$\left(\sqrt[3]{512}\right)^{-2} = (8)^{-2} = \frac{1}{8^2} = \boxed{\frac{1}{64}}$$

$$\frac{1}{512^{\frac{2}{3}}} = \frac{1}{\left(\sqrt[3]{512}\right)^2} = \frac{1}{8^2} = \frac{1}{64}$$

Objective: See structure in expressions to solve problems.

Concept

The Quadratic Function

standard form

$$f(x) = ax^2 + bx + c$$

•vertex $= \left(\frac{-b}{2a}, f\left(\frac{-b}{2a} \right) \right)$

Find the vertex and state whether it is a maximum or minimum.

$$g(x) = 2(x-1)^2 + 2$$

$vertex = (h,k) = (1,2)$

$a = 2,\ no\ reflection$

$\boxed{vertex: (1,2),\ \text{minimum}}$

$$f(x) = -x^2 + 6x + 3$$

$x = -\frac{b}{2a} = -\frac{6}{2(-1)} = \frac{-6}{-2} = 3$

$y = -1(3)^2 + 6(3) + 3 = 12$

$a = -1 \rightarrow x-axis\ reflection$

$\boxed{vertex: (3,12),\ \text{maximum}}$

Objective: See structure in expressions to solve problems.

Find the zeros of the function.

$$p(x) = -2x^2 + 4x + 6$$

$$0 = -2x^2 + 4x + 6$$

$$0 = -2(x^2 - 2x - 3)$$

$$0 = -2(x-3)(x+1)$$

$$-2 \neq 0, \quad x - 3 = 0, \quad x + 1 = 0$$

$$x = 3 \qquad x = -1$$

$$\boxed{zeros: -1, 3}$$

Objective: See structure in expressions to solve problems.

Find the zeros of the function.

$$g(x) = x^3 - 7x^2 - 8x$$

$0 = x^3 - 7x^2 - 8x$

$0 = x(x^2 - 7x - 8)$

$0 = x(x-8)(x+1)$

$x = 0, \quad x - 8 = 0, \quad x + 1 = 0$

$x = 8 \qquad x = -1$

$\boxed{zeros: -1, 0, 8}$

Objective: See structure in expressions to solve problems.

Rewrite $x^2 - 8x + 2$ in the form: $(x + \square)^2 + \square$

perfect square trinomial

$(x^2 - 8x + 16) + 2 - 16$

$\left(\frac{-8}{2}\right)^2$

$(-4)^2$

$(x - 4)(x - 4)$

$(x - 4)^2 - 14$

$(x + \boxed{-4})^2 + \boxed{-14}$

Objective: See structure in expressions to solve problems.

What is the factored form of $x^2 - 121y^2$?

$$(x)^2 - (11y)^2$$

$$\boxed{(x + 11y)(x - 11y)}$$

Objective: See structure in expressions to solve problems.

Rewrite the expression in simplest form.

$$\frac{x^2 - 2x - 8}{x^2 - 16}$$

$$\frac{(x-4)(x+2)}{(x-4)(x+4)} = \boxed{\frac{x+2}{x+4}}$$

What are the excluded x values of the expression? Explain your reasoning.

The excluded x values are -4 and 4 because they make the denominator of the original expression equal to 0.

Objective: See structure in expressions to solve problems.

Which of the following are equivalent to the given expression?

$$(x+6)^2 - (x-2)(x+6)$$

$A)\ 8x+48$

gcf

$B)\ (x+6)[(x+6)-(x-2)]$

$C)\ 8(x+6)$

$D)\ 4(2x+12)$

They are all equivalent to the given expression: A,B,C, and D.

Objective: See structure in expressions to solve problems.

What is the simplest form of $(5 - x + 2x^2) - (3x + 7) - (x^2 - 2)$?

$$5 - x + 2x^2 - 3x - 7 - x^2 + 2$$

$$\boxed{x^2 - 4x}$$

Objective: See structure in expressions to solve problems.

What is the simplest form of $(x^2x^5y^3)^3$?

$$\left(x^{2+5}y^3\right)^3 \rightarrow \left(x^7y^3\right)^3 \rightarrow x^{7\cdot 3}y^{3\cdot 3} \rightarrow \boxed{x^{21}y^9}$$

Objective: See structure in expressions to solve problems.

What is the simplest form of $\left(\frac{x^8}{x^2}\right)^2$?

$$\left(x^{8-2}\right)^2 \rightarrow \left(x^6\right)^2 \rightarrow x^{6\cdot 2} \rightarrow \boxed{x^{12}}$$

Objective: See structure in expressions to solve problems.

Which of the following equations are true for all values of x?

$a)\ 2^{4x} = 4^{2x} \quad \rightarrow 16^x = 16^x$

$b)\ 6^x = 3^{2x} \quad \rightarrow 6^x = 9^x$

$c)\ 2^{3x} = 8^x \quad \rightarrow 8^x = 8^x$

$d)\ 3^{3x} = 9^x \quad \rightarrow 27^x = 9^x$

a and c

Objective: See structure in expressions to solve problems.

Choose the domain for each function.

$f(x) = \sqrt{x-3}$	$x \neq 3$	$x \neq 4$	$x \geq 3$	$x \geq 3,$ $x \neq 4$
$f(x) = \frac{x-3}{x-4}$	$x \neq 3$	$x \neq 4$	$x \geq 3$	$x \geq 3,$ $x \neq 4$
$f(x) = \frac{x-4}{x-3}$	$x \neq 3$	$x \neq 4$	$x \geq 3$	$x \geq 3,$ $x \neq 4$
$f(x) = \frac{\sqrt{x-3}}{x-4}$	$x \neq 3$	$x \neq 4$	$x \geq 3$	$x \geq 3,$ $x \neq 4$