

Operations on Functions

Let f and g be any two functions. A new function can be defined by performing any of the four basic operations on f and g .

Operation	Definition	Example: $f(x) = 5x, g(x) = x + 2$
Addition	$(f + g)(x) = f(x) + g(x)$	$(f + g)(x) = 5x + (x + 2) = 6x + 2$
Subtraction	$(f - g)(x) = f(x) - g(x)$	$(f - g)(x) = 5x - (x + 2) = 4x - 2$
Multiplication	$(fg)(x) = f(x) \cdot g(x)$	$(fg)(x) = 5x(x + 2) = 5x^2 + 10x$
Division	$\left(\frac{f}{g}\right)(x) = \frac{f(x)}{g(x)}$	$\left(\frac{f}{g}\right)(x) = \frac{5x}{x + 2}$

The domains of the sum, difference, product, and quotient functions consist of the x -values that are in the domains of both f and g . Additionally, the domain of the quotient does not include x -values for which $g(x) = 0$.

FUNCTION BANK

$f(x) = 3\sqrt{x}$
 $n(x) = \sqrt{x}$
 $m(x) = x^2$

$g(x) = -10\sqrt{x}$
 $h(x) = 3x^2 - 2x^2 + 5$
 $q(x) = x^{\frac{3}{4}}$

$p(x) = 6x$
 $j(x) = x$
 $k(x) = x^3 - 3x^2 + 4x - 2$

TASK 1: Perform the indicated function operation. Then state the domain and solve for the indicated x value.

a) $(f + g)(x) = f(x) + g(x)$

$3\sqrt{x} + -10\sqrt{x} = \boxed{-7\sqrt{x}}$

Domain: $\boxed{[0, \infty)}$
 $(f + g)(4) = -7\sqrt{4} = \boxed{-14}$

b) $(h - k)(x) = h(x) - k(x) = (3x^3 - 2x^2 + 5) - (x^3 - 3x^2 + 4x - 2)$

$3x^3 - 2x^2 + 5 - x^3 + 3x^2 - 4x + 2 = \boxed{2x^3 + x^2 - 4x + 7}$

Domain: $\boxed{(-\infty, \infty)}$
 $(h - k)(-2) = -16 + 4 + 8 + 7 = \boxed{3}$

$$c) (mn)(x) =$$

$$(x^2)(\sqrt{x}) = \boxed{x^2\sqrt{x}}$$

$$d) \left(\frac{p}{q}\right)(x) = \frac{6x^{\frac{1}{4}}}{x^{\frac{3}{4}}} = 6x^{\frac{1}{4}-\frac{3}{4}} = \boxed{6x^{-\frac{1}{4}}}$$

$$\text{Domain: } [0, \infty)$$

$$(mn)(9) = 9\sqrt{9} = \boxed{243}$$

$$\text{Domain: } [0, \infty)$$

$$\frac{1}{6} (16)^{\frac{1}{4}} = \boxed{12}$$

$$e) (f-g)(x) =$$

$$3\sqrt{x} + 10\sqrt{x} = \boxed{13\sqrt{x}}$$

$$f) \left(\frac{j}{m}\right)(x) = \frac{x^{-\frac{3}{2}}}{x^{\frac{2}{2}}} = \frac{1}{x^{\frac{3}{2}+\frac{2}{2}}} = \frac{1}{x^{\frac{5}{2}}}$$

$$= \boxed{\frac{1}{x^{\frac{5}{2}}}}$$

$$\text{Domain: } [0, \infty)$$

$$x = 9 \quad 13\sqrt{9} = \boxed{39}$$

$$\text{Domain: } (0, \infty)$$

$$x = 0 \quad \text{undefined}$$

$$g) (h+k)(x) =$$

$$h(x) + k(x) = 3x^3 - 2x^2 + 5 + x^3 - 3x^2 + 4x - 2 = \boxed{4x^3 - 5x^2 + 4x + 3}$$

$$h) (pn)(x) =$$

$$\boxed{6x\sqrt{x}}$$

$$\text{Domain: } (-\infty, \infty)$$

$$(h+k)(-1) = -4 - 5 - 4 + 3 = \boxed{-10}$$

$$\text{Domain: } [0, \infty)$$

$$(pn)(-3) = -18\sqrt{-3} = \boxed{-18i\sqrt{3}}$$

Still need help with: