

Multiple Choice. Choose the best answer.

1. Determine the restriction(s) for  $f(x) = \frac{x^2 + 3x + 2}{x^2 + 5x + 6}$

- a.  $x \neq -3$   
b.  $x \neq 2$  or 3  
c.  $x \neq -2$  or  $-3$   
d.  $x \neq -1$  or  $-2$

$(x+3)(x+2)$   
 $x \neq -3, -2$

2. Determine the restriction(s) for  $f(x) = \frac{x^2 + x - 6}{x^2 - x - 2}$

- a.  $x \neq 2$   
b.  $x \neq 2$  or  $-1$   
c.  $x \neq -2$  or 1  
d.  $x \neq -3$  or 2

$(x-2)(x+1)$   
 $x \neq 2, -1$

3. The least common denominator for  $\frac{x+3}{x^2+9x+20} - \frac{1}{3x+12}$  is:

- a.  $(x+4)^2(x+5)$   
b.  $3(x+4)^2(x+5)$   
c.  $(3x+12)(x+4)(x+5)$   
d.  $3(x+4)(x+5)$

$(x+5)(x+4)$   $3(x+4)$

4. The least common denominator for  $\frac{5x}{x^2+5x+4} + \frac{1}{3x+3}$  is:

- e.  $3(x+1)^2(x+4)$   
f.  $(3x+3)(x+1)(x+4)$   
g.  $3(x+1)(x+4)$   
h.  $(x+4)(x+1)^2$

$(x+4)(x+1)$   $3(x+1)$

Variation. Solve the variation problems below.

5. Suppose y varies inversely as x, and y = 6 when x = 16. Determine x when y = 4.

$y = \frac{k}{x}$   
 $6 = \frac{k}{16}$   
 $k = 96$   
 $y = \frac{96}{x}$   
 $\frac{4}{1} = \frac{96}{x}$   
 $4x = 96$   
 $x = 24$

6. Suppose y varies jointly as x and z. If y = 450 when x = 10 and z = 15, determine z when y = 1500 and x = 5.

$y = kxz$   
 $450 = k(10)(15)$   
 $450 = 150k$   
 $k = 3$   
 $y = 3xz$   
 $1500 = 3(5)z$   
 $1500 = 15z$   
 $z = 100$

7. The distance a spring stretches varies directly as the amount of weight that is hanging on it. A weight of 2.5 pounds stretches a spring 18 inches. Find the stretch of a spring when a weight of 6.4 pounds is hanging on it.

$d = kw$   
 $18 = k(2.5)$   
 $k = 7.2$   
 $d = 7.2w$   
 $d = 7.2(6.4)$   
 $d = 46.08 \text{ in}$

8. The number of miles traveled in a car varies directly with the number of gallons that you use. Suppose you drove 392 miles on 14 gallons of gas. How far can you travel if you only have 3.7 gallons of gas?

$m = kg$   
 $392 = k(14)$   
 $k = 28$   
 $m = 28g$   
 $m = 28(3.7)$   
 $m = 103.6 \text{ mi}$

**Variation. Solve the variation problems below.**

9. Suppose  $y$  varies inversely as  $x$ , and  $y = -5$  when  $x = 3$ . Determine  $x$  when  $y = 1.5$ .

$$y = \frac{k}{x} \quad y = \frac{-15}{x}$$

$$-5 = \frac{k}{3} \quad 1.5 = \frac{-15}{x}$$

$$-15 = k \quad 1.5x = -15$$

$$\boxed{x = -10}$$

10. Suppose  $y$  varies jointly as  $x$  and  $z$ . If  $y = 60$  when  $x = 2$  and  $z = 3$ , determine  $z$  when  $y = 360$  and  $x = 4$ .

$$y = kxz \quad y = 10xz$$

$$60 = k(2)(3) \quad 360 = 10(4)z$$

$$60 = 6k \quad 360 = 40z$$

$$k = 10 \quad \boxed{z = 9}$$

**Simplify. State any restrictions on the variables.**

11.  $\frac{x^2+5x}{x^2-25} \cdot \frac{x^2+3x-10}{x^2-2x}$

$$\frac{\cancel{x}(x+5)}{(x+5)(x-5)} \cdot \frac{(x+5)(x-2)}{\cancel{x}(x-2)} = \boxed{\frac{x+5}{x-5}}$$

$$\boxed{x \neq -5, 5, 0, 2}$$

12.  $\frac{a^2+8a+15}{a^2+10a+25} \div \frac{a^2-9}{a^2+5a} \quad \div, \text{ mult by recip}$

$$\frac{(a+5)(a+3)}{(a+5)(a+5)} \times \frac{a(a+5)}{(a+3)(a-3)} = \boxed{\frac{a}{a-3}}$$

$$\boxed{a \neq -5, -3, 3, 0}$$

13.  $\frac{x^2-5x+6}{x^2-4} \cdot \frac{x^2+3x+2}{x^2-2x-3}$

$$\frac{(x-3)(x-2)}{(x-2)(x+2)} \cdot \frac{(x+2)(x+1)}{(x-3)(x+1)} = \boxed{1}$$

$$\boxed{x \neq 2, -2, 3, -1}$$

14.  $\frac{a^2}{a^2+2a+1} \div \frac{3a}{a^2-1} \quad \text{see \#12}$

$$\frac{a^2}{(a+1)(a+1)} \times \frac{(a+1)(a-1)}{3a} = \boxed{\frac{a(a-1)}{3(a+1)}}$$

$$\boxed{a \neq -1, 1, 0}$$

**Simplify. You do NOT need to state restrictions. Circle your answers.**

15.  $\frac{x+2}{x^2-5x+6} + \frac{x-3}{x^2-9}$

$$\frac{(x+2)}{(x-3)(x-2)} + \frac{(x-3)}{(x-3)(x+3)} \cdot \frac{(x-2)}{(x-2)}$$

$$\frac{x^2+2x+3x+6}{(x+3)(x-3)(x-2)} + \frac{x^2-2x-3x+6}{(x+3)(x-3)(x-2)}$$

$$\boxed{\frac{2x^2+12}{(x+3)(x-3)(x-2)}}$$

16.  $\frac{2y+3}{2y+8} - \frac{y+6}{3y+12} \quad \text{distribute neg!}$

$$\frac{3}{3} \cdot \frac{2y+3}{2(y+4)} + \frac{-y-6}{3(y+4)} \cdot \frac{2}{2}$$

$$\frac{6y+9}{6(y+4)} + \frac{-2y-12}{6(y+4)}$$

$$\boxed{\frac{4y-3}{6(y+4)}}$$

Simplify. You do NOT need to state restrictions. Circle your answers.

17.  $\frac{3x}{x^2+5x+6} + \frac{2x}{x^2+6x+8}$

$\frac{(x+4)}{(x+4)} \cdot \frac{3x}{(x+3)(x+2)} + \frac{2x}{(x+4)(x+2)} \cdot \frac{(x+3)}{(x+3)}$

$\frac{3x^2+12x}{(x+4)(x+3)(x+2)} + \frac{2x^2+6x}{(x+4)(x+2)(x+3)}$

$\frac{5x^2+18x}{(x+4)(x+3)(x+2)}$

18.  $\frac{2y+3}{2y+6} - \frac{y+6}{5y+15}$

See #16!

$\frac{5}{5} \frac{2y+3}{2(y+3)} + \frac{-y-6}{5(y+3)} \cdot \frac{2}{2}$

$\frac{10y+15}{10(y+3)} + \frac{-2y-12}{10(y+3)}$

$\frac{8y+3}{10(y+3)}$

Solve. Check your solutions. You do NOT need to state restrictions.

19.  $\frac{1}{x-4} \neq \frac{x}{x^2-16}$

$x^2-4x = x^2-16$

$-4x = -16$

$x = 4 \leftarrow \text{ext}$

$\frac{1}{4-4} = \frac{4}{4^2-16}$

$\frac{1}{0} = \frac{4}{0}$

No sol.

20.  $\frac{15}{x} + \frac{x}{x} \frac{9x-7}{x+2} = \frac{9}{1} \cdot \frac{x(x+2)}{x(x+2)}$

$\frac{15x+30 + 9x^2-7x}{x(x+2)} = \frac{9x^2+18x}{x(x+2)}$

$9x^2+8x+30 = 9x^2+18x$

$8x+30 = 18x$

$30 = 10x$

$3 = x$

$\frac{15}{3} + \frac{9 \cdot 3-7}{3+2} = 9$

$5 + 4 = 9 \checkmark$

21.  $\frac{3}{x+1} \neq \frac{2x}{x^2-1}$

$2x^2+2x = 3x^2-3$

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

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

ext

$x = 3, \neq \text{ext}$

$x = 3$

$\frac{3}{3+1} = \frac{2(3)}{3^2-1}$

$\frac{3}{-1+1} = \frac{2(-1)}{(-1)^2-1}$

$\frac{3}{4} = \frac{6}{8}$

$\frac{3}{0} = \frac{-2}{0}$

$\frac{3}{4} = \frac{3}{4}$

22.  $\frac{5}{4} + \frac{4}{4} \frac{3}{x+4} = \frac{18}{x+4} \cdot \frac{4}{4}$

$\frac{5x+20+12}{4(x+4)} = \frac{72}{4(x+4)}$

$5x+32 = 72$

$5x = 40$

$x = 8$

$\frac{5}{4} + \frac{3}{8+4} = \frac{18}{8+4}$

$\frac{5}{4} + \frac{3}{12} = \frac{18}{12}$

$\frac{15}{12} + \frac{3}{12} = \frac{18}{12}$

$\frac{18}{12} = \frac{18}{12} \checkmark$

23. Working alone, a farmer can plow a field in 4 hours. The farmer's son can plow the field by himself in 12 hours. How long would it take the farmer and his son if they plowed the field together?

|        | Alone<br>1 hr  | together | part of job<br>completed |
|--------|----------------|----------|--------------------------|
| Farmer | $\frac{1}{4}$  | $x$      | $\frac{x}{4}$            |
| Son    | $\frac{1}{12}$ | $x$      | $\frac{x}{12}$           |

$$\frac{3}{3} \cdot \frac{x}{4} + \frac{x}{12} = \frac{1}{1} \cdot \frac{12}{12}$$

$$\frac{3x}{12} + \frac{x}{12} = \frac{12}{12}$$

$$\frac{4x}{12} = \frac{12}{12}$$

$$4x = 12$$

$$x = 3$$

(1 job total)

3 hrs

24. Working alone, Phillip can weed the garden in 9 hours. Working together with Adriana, they need 3 hours to weed the garden. How long would it take Adriana working alone to weed the garden?

|         | Alone<br>1 hr | together | part of job<br>completed |
|---------|---------------|----------|--------------------------|
| Phillip | $\frac{1}{9}$ | 3        | $\frac{3}{9}$            |
| Adriana | $\frac{1}{x}$ | 3        | $\frac{3}{x}$            |

$$\frac{x}{x} \cdot \frac{3}{9} + \frac{3}{x} \cdot \frac{1}{1} = \frac{1}{1} \cdot \frac{9}{9x}$$

$$\frac{3x}{9x} + \frac{27}{9x} = \frac{9x}{9x}$$

$$3x + 27 = 9x$$

$$27 = 6x$$

$$x = 4.5 \text{ hrs}$$