

Simplify each and state the excluded values. (factor and reduce - excluded values are what makes the denominator zero)

$$1) \frac{a-9}{a^2-10a+9}$$

$$\frac{1}{a-1}; \{9, 1\}$$

$$3) \frac{4-n}{n^2-16}$$

$$-\frac{1}{n+4}; \{4, -4\}$$

$$5) \frac{x+10}{x^2+17x+70}$$

$$\frac{1}{x+7}; \{-10, -7\}$$

$$7) \frac{x^2+14x+45}{x+9}$$

$$x+5; \{-9\}$$

$$9) \frac{45n-9}{18n}$$

$$\frac{5n-1}{2n}; \{0\}$$

$$11) \frac{v^2+7v-18}{5v+45}$$

$$\frac{v-2}{5}; \{-9\}$$

$$13) \frac{x^2-12x+27}{x^2-5x-36}$$

$$\frac{x-3}{x+4}; \{9, -4\}$$

$$15) \frac{k^2+3k-4}{k^2-8k+7}$$

$$\frac{k+4}{k-7}; \{7, 1\}$$

$$17) \frac{2n^2-10n+12}{2n^2-14n+24}$$

$$\frac{n-2}{n-4}; \{4, 3\}$$

$$19) \frac{7x^2+32x-15}{2x^2+6x-20}$$

$$\frac{7x-3}{2(x-2)}; \{2, -5\}$$

$$2) \frac{10p+18}{12}$$

$$\frac{5p+9}{6}; \text{No excluded values.}$$

$$4) \frac{p^2-6p-27}{p+3}$$

$$p-9; \{-3\}$$

$$6) \frac{k-8}{6k^2-48k}$$

$$\frac{1}{6k}; \{0, 8\}$$

$$8) \frac{n^2-10n+24}{n-4}$$

$$n-6; \{4\}$$

$$10) \frac{x^2+9x-10}{x+10}$$

$$x-1; \{-10\}$$

$$12) \frac{k^2+2k+1}{k^2-5k-6}$$

$$\frac{k+1}{k-6}; \{6, -1\}$$

$$14) \frac{6x^2-9x}{9x^2-3x}$$

$$\frac{2x-3}{3x-1}; \left\{0, \frac{1}{3}\right\}$$

$$16) \frac{n^2-n-90}{9n+81}$$

$$\frac{n-10}{9}; \{-9\}$$

$$18) \frac{2p^2+15p+25}{7p^2+43p+40}$$

$$\frac{2p+5}{7p+8}; \left\{-5, -\frac{8}{7}\right\}$$

$$20) \frac{56x^2+64x}{24x^2+40x}$$

$$\frac{7x+8}{3x+5}; \left\{0, -\frac{5}{3}\right\}$$

Simplify each expression.

1)  $\frac{1}{5n} \div \frac{n+3}{5n^2+15n}$

$$\frac{1}{1}$$

2)  $\frac{x+5}{x^2+4x-5} \div \frac{1}{6x}$

$$\frac{6x}{x-1}$$

3)  $\frac{2p-14}{2p-16} \div \frac{4p^2}{p-8}$

$$\frac{p-7}{4p^2}$$

4)  $\frac{14b-4}{5b^2} \div \frac{14b-4}{4b}$

$$\frac{4}{5b}$$

5)  $\frac{x-2}{x^2+7x-18} \div \frac{3}{x-1}$

$$\frac{x-1}{3(x+9)}$$

6)  $\frac{1}{x+1} \div \frac{6x^2}{x^2+9x+8}$

$$\frac{x+8}{6x^2}$$

7)  $\frac{1}{10n^2} \cdot \frac{8n^3-80n^2}{8n^2}$

$$\frac{n-10}{10n^2}$$

8)  $\frac{n^2-25}{2} \cdot \frac{2}{n^2-25}$

$$1$$

9)  $\frac{p^2+8p+7}{p+5} \cdot \frac{p-7}{p^2-49}$

$$\frac{p+1}{p+5}$$

10)  $\frac{1}{b-5} \cdot \frac{6b^2+54b}{b+9}$

$$\frac{6b}{b-5}$$

$$11) \frac{2}{n-8} \cdot \frac{4n^2-32n}{2}$$

$$\frac{4n}{1}$$

$$12) \frac{k-9}{k-6} \cdot \frac{k^2-8k+12}{10k-20}$$

$$\frac{k-9}{10}$$

$$13) \frac{27a^2}{5a^2-41a-36} \div \frac{1}{5a+4}$$

$$\frac{27a^2}{a-9}$$

$$14) \frac{2v+3}{6v^2-9v-27} \div \frac{v-10}{3v^2-6v-9}$$

$$\frac{v+1}{v-10}$$

$$15) \frac{1}{7a-9} \div \frac{80a}{49a-63}$$

$$\frac{7}{80a}$$

$$16) \frac{10}{10x-60} \div \frac{1}{x+9}$$

$$\frac{x+9}{x-6}$$

$$17) \frac{-14r^2+51r-7}{2r-7} \cdot \frac{r-2}{7r-1}$$

$$-r+2$$

$$18) \frac{15n-18}{18-15n} \cdot \frac{n-7}{8}$$

$$\frac{-n+7}{8}$$

$$19) \frac{1}{3x+1} \cdot \frac{3x^2+28x+9}{x-3}$$

$$\frac{x+9}{x-3}$$

$$20) \frac{12n^3+32n^2}{n-3} \cdot \frac{3n-3}{9n^2+15n-24}$$

$$\frac{4n^2}{n-3}$$

Simplify each expression.

1)  $\frac{6}{3} + \frac{6}{x-3}$

$$\frac{2x}{x-3}$$

2)  $\frac{3k}{6} - \frac{k-5}{k+4}$

$$\frac{k^2 + 2k + 10}{2(k+4)}$$

3)  $\frac{3r}{5r} - \frac{r+3}{r-2}$

$$\frac{-2r-21}{5(r-2)}$$

4)  $\frac{2}{x-5} + \frac{3x}{x-1}$

$$\frac{-13x-2+3x^2}{(x-5)(x-1)}$$

5)  $\frac{5}{3r^2-9r} - \frac{6}{3r}$

$$\frac{23-6r}{3r(r-3)}$$

6)  $4m + \frac{5}{12m-4}$

$$\frac{48m^2-16m+5}{4(3m-1)}$$

7)  $\frac{2}{2b} + \frac{6b}{b-2}$

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

8)  $\frac{5}{2k-4} + \frac{4}{3}$

$$\frac{-1+8k}{6(k-2)}$$

9)  $\frac{3}{n-6} + \frac{4}{3}$

$$\frac{-15+4n}{3(n-6)}$$

10)  $\frac{3a}{a-5} + \frac{5}{2}$

$$\frac{11a-25}{2(a-5)}$$

11)  $\frac{7n}{n+4} - \frac{8}{6n}$

$$\frac{21n^2-4n-16}{3n(n+4)}$$

12)  $\frac{2}{n-6} - \frac{4}{n-7}$

$$\frac{-2n+10}{(n-7)(n-6)}$$

$$13) \frac{5n}{3n-6} + \frac{6}{n-5}$$

$$\frac{5n^2 - 7n - 36}{3(n-5)(n-2)}$$

$$14) \frac{5}{x+8} - \frac{2x}{x-1}$$

$$\frac{-2x^2 - 11x - 5}{(x-1)(x+8)}$$

$$15) \frac{2x}{2x-6} + \frac{2}{x-7}$$

$$\frac{x^2 - 5x - 6}{(x-7)(x-3)}$$

$$16) \frac{7r+4}{3r-8} - \frac{2r}{7}$$

$$\frac{65r + 28 - 6r^2}{7(3r-8)}$$

$$17) \frac{3}{n+6} + \frac{5}{7n-6}$$

$$\frac{26n + 12}{(7n-6)(n+6)}$$

$$18) \frac{5}{2v+3} - \frac{7v}{v-6}$$

$$\frac{-14v^2 - 16v - 30}{(v-6)(2v+3)}$$

$$19) \frac{3}{2} - \frac{2x}{3x+24}$$

$$\frac{5x + 72}{6(x+8)}$$

$$20) \frac{2x}{x-2} + \frac{2x}{x+8}$$

$$\frac{4x^2 + 12x}{(x-2)(x+8)}$$

$$21) \frac{3}{5} + \frac{6b}{2b^2 + b - 1}$$

$$\frac{6b^2 + 33b - 3}{5(2b-1)(b+1)}$$

$$22) \frac{n+2}{5n^2 + 17n - 12} + \frac{2n}{4}$$

$$\frac{-10n + 4 + 5n^3 + 17n^2}{2(5n-3)(n+4)}$$

$$23) \frac{k+6}{5k^2 + 14k - 24} + \frac{4k}{3}$$

$$\frac{-93k + 18 + 20k^3 + 56k^2}{3(5k-6)(k+4)}$$

$$24) \frac{4}{m+1} - \frac{3m}{m-5}$$

$$\frac{m - 20 - 3m^2}{(m-5)(m+1)}$$

Simplify each expression.

$$1) \frac{\frac{2}{3} + \frac{1}{u}}{2}$$

$$\frac{2u + 3}{6u}$$

$$2) \frac{\frac{16}{x+2} - \frac{3}{x+2}}{\frac{1}{3}}$$

$$\frac{39}{x+2}$$

$$3) \frac{\frac{m-5}{1} - \frac{16}{m-5}}{4}$$

$$\frac{4m^2 - 40m + 100}{m - 69}$$

$$4) \frac{\frac{3}{x}}{\frac{3}{25} + \frac{3}{x^2}}$$

$$\frac{25x}{x^2 + 25}$$

$$5) \frac{\frac{3}{5} + \frac{x}{9}}{\frac{4}{x} + \frac{x^2}{2}}$$

$$\frac{54x + 10x^2}{360 + 45x^3}$$

$$6) \frac{\frac{5}{4x+8} - \frac{2}{25}}{\frac{5}{4} + \frac{2}{5}}$$

$$\frac{109 - 8x}{165x + 330}$$

$$7) \frac{\frac{x-5}{9} + \frac{x-3}{x-5}}{\frac{x^2-3x}{3x-15} + \frac{1}{x}}$$

$$\frac{x^3 - x^2 - 2x}{3x^3 - 9x^2 + 9x - 45}$$

$$8) \frac{\frac{4}{x-4} + \frac{16}{x}}{\frac{16}{x^2} - \frac{x^2}{4}}$$

$$\frac{80x^2 - 256x}{64x - x^5 - 256 + 4x^4}$$

$$9) \frac{\frac{u+5}{6} + \frac{u+5}{u-4}}{\frac{2}{3} - \frac{1}{2}}$$

$$\frac{u^2 + 7u + 10}{u - 4}$$

$$10) \frac{\frac{12}{x+3} + \frac{18}{x+3}}{\frac{1}{6} + \frac{x+3}{6}}$$

$$\frac{180}{7x + x^2 + 12}$$

$$11) \frac{\frac{2}{3} - \frac{4}{a^2}}{\frac{4}{a} + \frac{3}{2}}$$

$$\frac{4a^2 - 24}{24a + 9a^2}$$

$$12) \frac{\frac{x}{12} - \frac{2}{3}}{\frac{2}{3} + \frac{x}{4}}$$

$$\frac{x - 8}{8 + 3x}$$

Solve each equation. Remember to check for extraneous solutions.

1)  $\frac{6}{5x} = \frac{1}{5x} + \frac{1}{x^2}$

 $\{1\}$ 

2)  $\frac{1}{2x} - \frac{5}{6x^2} = \frac{1}{6x}$

 $\left\{\frac{5}{2}\right\}$ 

3)  $\frac{1}{k^2} = \frac{6}{k} + \frac{6}{k^2}$

 $\left\{-\frac{5}{6}\right\}$ 

4)  $\frac{1}{x^2} = \frac{3}{2x} - \frac{1}{4x^2}$

 $\left\{\frac{5}{6}\right\}$ 

5)  $\frac{1}{4p} + \frac{1}{4} = \frac{3}{2}$

 $\left\{\frac{1}{5}\right\}$ 

6)  $\frac{2x-2}{x^2} = \frac{1}{2x^2} - \frac{x-4}{2x^2}$

 $\left\{\frac{9}{5}\right\}$ 

7)  $\frac{x+5}{2x^2} = \frac{1}{2x^2} + \frac{1}{6x}$

 $\{-6\}$ 

8)  $\frac{b+5}{b} + \frac{1}{b} = \frac{1}{3}$

 $\{-9\}$ 

9)  $\frac{1}{x+6} - \frac{x+1}{x^2+6x} = \frac{x-8}{x^2+6x}$

 $\{7\}$ 

10)  $\frac{7}{v^2+5v+6} = \frac{1}{2v^2+10v+12} + \frac{1}{2v+6}$

 $\{11\}$



$$11) \frac{1}{4m^2 + 32m} - \frac{m-4}{4m^2 + 32m} = \frac{1}{2m^2 + 16m}$$

$$\{3\}$$

$$12) \frac{7}{r-3} + \frac{1}{r^2 - 3r} = \frac{7}{r^2 - 3r}$$

$$\left\{ \frac{6}{7} \right\}$$

$$13) \frac{n+6}{8n+1} = 1 + \frac{8}{8n+1}$$

$$\left\{ -\frac{3}{7} \right\}$$

$$14) \frac{1}{4n-32} + \frac{1}{4} = \frac{n-1}{2n-16}$$

$$\{-5\}$$

$$15) \frac{1}{a^2 + 3a} = \frac{3}{a} - \frac{7}{a^2 + 3a}$$

$$\left\{ -\frac{1}{3} \right\}$$

$$16) \frac{1}{v-1} + \frac{4}{v-1} = \frac{1}{v-5}$$

$$\{6\}$$

$$17) \frac{x+1}{4x+28} = \frac{x+4}{2x+14} + \frac{1}{4x-28}$$

$$\{6\}$$

$$18) \frac{x+4}{4x} + \frac{3}{2x^2 + 12x} = \frac{1}{4}$$

$$\left\{ -\frac{15}{2} \right\}$$

$$19) 1 = \frac{1}{r^2 - 3r} + \frac{r-3}{r}$$

$$\left\{ \frac{10}{3} \right\}$$

$$20) \frac{1}{n+7} = \frac{n^2 + 11n + 24}{n+7} - (n+7)$$

$$\left\{ -\frac{26}{3} \right\}$$