For problems 1 - 3, find all numbers for which the rational expression is undefined.

1. a) $\frac{28}{-8y}$ b) $\frac{y-4}{y+6}$

2. a) $\frac{x^2-9}{4x-12}$ b) $\frac{p^2-9}{p^2-7p+10}$

3. a) $\frac{7-3x+x^2}{49-x^2}$ b) $\frac{x_2-25}{14}$

4. Multiply. Do not simplify.

a) $\frac{2a-3}{5a+2}\cdot\frac{a}{a}$ b) $\frac{x^2+1}{x^3-2}\cdot\frac{x-4}{x-4}$

For problems 5 - 13, simplify the rational expression to be the simplest form

5. a) $\frac{4x^2}{20x}$ b) $\frac{-76x^8y^3}{-24x^4y^3}$

6. a) $\frac{4y^2-2y}{5y^2-5y}$ b) $\frac{t^2-25}{t^2+t-20}$

7. a) $\frac{x^2-2x-8}{x^2-x-6}$ b) $\frac{x^2+8x+16}{x^2-16}$

8. a) $\frac{t^2-1}{t+1}$ b) $\frac{m^2+9}{m+3}$

9. a) $\frac{8x^2-32}{4x^2-16}$ b) $\frac{4x+32}{x^2+9x+8}$

10. a) $\frac{3a^2-9a-12}{6a^2+30a+24}$ b) $\frac{m^2-10m+25}{m^2-25}$

11. a) $\frac{5a-15}{3-a}$ b) $\frac{a^2-b^2}{b^2-a^2}$

For problems 12 -13, multiply and simplify.

12. a) $\frac{3x^2}{2}\cdot\frac{4}{xy^3}$ b) $\frac{t^2}{t^2-4}\cdot\frac{t^2-5t+6}{t^2-3t}$

13. a) $\frac{x^2+10x-11}{x^2-1}\cdot\frac{x+1}{x+11}$ b) $\frac{x^4-1}{x^4-81}\cdot\frac{x^2+9}{x^2+1}$

14. Factor:

a) $a^2-16a+64$ b) $2y^3-10y^2+y-5$

15. Explain how a rational expression can be formed for which -3 and 4 are not allowable replacements.

For problems 16 -17, find the reciprocal of the rational expressions.

16. a) $\frac{a+3}{a-1}$ b) x^2-5x+7

17. a) $\frac{x^2}{x^2-3}$ b) $\frac{(a-b)(a+b)}{(a+4)(a+5)}$

For problems 18 - 23, divide and simplify.

18. a) $\frac{3}{10}\div\frac{3}{2}$ b) $\frac{t}{3}\div\frac{t}{15}$

19. $\frac{4y-8}{y+2}\div\frac{y-2}{y^2-4}$ 20. $\frac{a}{a-b}\div\frac{b}{a-b}$

21. a) $\frac{4y-12}{12}\div\frac{y-3}{3}$ b) $\frac{-12+4x}{4}\div\frac{-6+2x}{6}$

22. a) $\frac{t-3}{t+2}\div\frac{4t-12}{t+1}$ b) $\frac{x+y}{x-y}\div\frac{x^2+y}{x^2-y^2}$

23. a) $\frac{a-b}{2a} \div \frac{a^2-b^2}{8a^3}$ b) $\frac{y+5}{2y} \div \frac{y^2-25}{4y^2}$

24. a) subtract: $\left(3p^2-6pq+7q^2\right)-\left(5p^2-10pq+11q^2\right)$

b) Simplify: $\left(\frac{a^{-3}}{b^4}\right)^5$

25. Explain why 5, -1, and 7 are not allowable replacements in the division

$$\frac{x+3}{x-5} \div \frac{x-7}{x+1}$$