

Name:

Sections 1.3 and 1.4 Exercises :: Math 115

x	1	12
x	2	6
	3	4
	4	3
	6	2
	12	1

Answer the following

1. Factor  $x^2 + 15x + 56$ . Now factor this  $15x^2 - 11x - 12$ .

$$(x+7)(x+8)$$

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

2. Factor each expression

difference of squares  
two cubes

Expression	Factored
$a^2 - b^2$	$(a-b)(a+b)$
$a^3 - b^3$	$(a-b)(a^2 + ab + b^2)$

Expression	Factored
$4x^2 - 9$	$(2x)^2 - 3^2 = (2x-3)(2x+3)$
$8x^3 - 27$	$(2x-3)(4x^2 + 6x + 9)$

3. Factor  $y^3 - 3y^2 - 4y + 12$ . Hint: try grouping

$$y^2(y-3) - 4(y-3) = (y-3)(y^2 - 4) = (y-3)(y-2)(y+2)$$

4. Find the domains of the expressions

Expression	Domain
$3x^2 + 2x - 17$	$\mathbb{R}$
$\sqrt{x-3}$	$\{x   x \geq 3\}$

Expression	Domain
$\frac{3x-1}{x-3}$	$(-\infty, 3) \cup (3, \infty)$
$\frac{1}{\sqrt{x-1}}$	$\{x   x > 1\}$

5. When we simplify rational expressions we factor top & bottom, then cancel:  $\frac{AC}{BC} = \frac{A}{B}$ . Simplify this expression:

$$\frac{x^2 + 6x + 8}{x^2 + 5x + 4} = \frac{(x+2)(x+4)}{(x+1)(x+4)} = \frac{x+2}{x+1}$$

6. Multiply rational expressions just as you do fractions: top-times-top, bottom-times-bottom.

$$\frac{x}{x+1} * \frac{x+2}{x+3} = \frac{x^2 + 2x}{(x+1)(x+3)} = \frac{x^2 + 2x}{x^2 + 4x + 3}$$

7. Divide rational expressions just as you do fractions: flip-flop the bottom, and multiply by the top.

$$\frac{x}{\left(\frac{2}{x+1}\right)} = x * \frac{x+1}{2} = \frac{x^2 + x}{2}$$

8. Adding and subtracting rational expressions requires first finding a common denominator.

$$\left(\frac{x+3}{x+3}\right) \frac{x}{x+1} + \frac{2}{x+3} \left(\frac{x+1}{x+1}\right) = \frac{x^2+3x+2x+2}{(x+1)(x+3)}$$

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

9. Simplifying a compound fraction (combine minor denoms first, then flip flop and multiply)

$$\frac{\frac{x}{y^2} - \frac{y}{x^2}}{\frac{1}{x^2} - \frac{1}{y^2}} = \frac{\frac{xy}{y^2x^2} - \frac{y^2}{x^2y^2}}{\frac{y^2 - x^2}{x^2y^2}} = \frac{\frac{xy}{x^2y^2} - \frac{y^2}{x^2y^2}}{\frac{y^2 - x^2}{x^2y^2}} = \frac{xy - y^2}{y^2 - x^2}$$

$$\frac{x^2 - y^2}{xy} \cdot \frac{(xy)}{y^2 - x^2} = \frac{(x^2 - y^2)xy}{(y^2 - x^2)} = \frac{-(y^2 - x^2)xy}{(y^2 - x^2)} = -xy$$

10. Common calculus simplification.

$$\frac{a}{a} \cdot \frac{1}{a+h} - \frac{1}{a} \cdot \frac{a+h}{a+h} = \frac{a - (a+h)}{a(a+h)} = \frac{-h}{a(a+h)} = \frac{-1}{a(a+h)} \left(\frac{h}{1}\right)$$

11. Rational exponent factoring and simplification

$$\frac{(1+x^2)^{1/2} - x^2(1+x^2)^{-1/2}}{1+x^2} = \frac{(1+x^2)^{-1/2} \left( (1+x^2)^1 - x^2 \cdot 1 \right)}{(1+x^2)} = \frac{(1+x^2)^{-1/2} \cdot 1}{(1+x^2)} = \frac{1}{(1+x^2)^{3/2}}$$

12. Rationalize Denominator or Numerator: Hint - conjugate radical

$$\frac{1}{1+\sqrt{2}} \cdot \left(\frac{1-\sqrt{2}}{1-\sqrt{2}}\right) = \frac{1-\sqrt{2}}{1-2} = \frac{1-\sqrt{2}}{-1} = \sqrt{2}-1$$