Student's Name:

Homework Log

MCR 3U1 – Gr. 11 University Mathematics

Unit 1: Rational Expressions (Text Chapter 2 &3)

Means complete every other part of the question (eg. a,c,e…).

Day	Section	Topic	Assigned Work
1	2.1 2.2	**Review of Polynomials:** Adding, Subtracting and Multiplying Polynomials	Handout Pg. 88 #1-3,(4-8)*, 9,11,12 Pg. 95 #1-3, (4-6)*,9
2	2.3	Factoring Polynomials	Worksheet Pg. 102 # 1-9
3	2.3	Factoring Polynomials	Worksheet
4	2.4	Simplifying Rational Expressions	Pg. 112 #1-5, 7-12, 17b
5	2.6	Multiplying and Dividing Rational Expressions	Pg. 121 #1-4, 5-7(c, d only), 8-11, 12, 13
6	2.7	Adding and Subtracting Rational Expressions Part 1	Pg. 128 # 1-6
7	2.7	Adding and Subtracting Rational Expressions Part 2	Pg. 128 # 7-10 Worksheet
8	3.4	Operations with Radicals Part 1	Pg. 167 # 1-9
9	3.4	Operations with Radicals Part 2	Worksheet #1-7 bdf
10		**Applications**	Worksheet
11		Review	Pg. 132 #1-3, 5, 6-8*, 9bd, 11-12, 13cd, 14cd, 15 Pg. 134 #1-9 Pg. 202 #9,11
12		**UNIT TEST**	

Unit 1 – Lesson 1: Review of Polynomials (Add/Subt/Expand/Simplify)

Target: 1) I will review grade 10 concepts of adding/subtracting polynomials
2) I can expand and simplify polynomials with varying degrees and different variables
3) I can extend these concepts to word problems: "write a simplified expression for the volume of a cube with side lengths of x+3"

Part 1: Using distributive property to expand a monomial multiplied by a polynomial

Step 1: Use distributive to get rid of brackets
Step 2: Add like terms

Example 1:

a) $4x(6x^2 - 7x + 2)$

b) $5(4x^2 - 3x) - (18x^2 - 16x) + 8$

Part 2: Multiplying together binomials

Step 1: Multiply the second binomial by each of the terms in the first binomial
Step 2: Add like terms

Example 2:

a) $(2x + 3)(4x - 7)$

b) $-3(2p - 5q)(4p + 3q)$

c) $(2x - 5)(3x^2 - 6x + 7)$

Part 3: Expanding multiple sets of brackets

Step 1: Expand and simplify rounded brackets first
Step 2: Expand and simplify square brackets next

Example 3:

a) $6[4(2x - 5) - 3(x + 4)]$

b) $4w[7 - w(2w - 5)] - [5 - w(w - 7)]$

Day 1 :

2.1 EXPANDING AND SIMPLIFYING POLYNOMIALS – WORKSHEET

Review: Adding, Subtracting, and Multiplying Polynomials

- To add polynomials, collect like terms.
- To subtract polynomials, add the opposite.
- To multiply polynomials, use the distributive law (or FOIL).
- Useful patterns: $(a + b)(a - b) = a^2 - b^2$; $(a \pm b)^2 = a^2 \pm 2ab + b^2$

1. Simplify.

a) $(7a+5b+3c)+(9a+6b+5c)$

b) $(p+q-r)+(r+p-s)+(p-s-r-q)$

c) $(3x+y+z)+(-7x-4y+3z)+(4x-y-z)$

d) $(17a-13x+27)-(15a-11x+9)$

e) $(4a^2-7xy-7y^3)-(-3a^2+7xy-9y^3)$

2. a) From $p^2 - 3p + 4$ subtract $-2p - 1$.

b) Subtract the sum of $x + 3$ and $-2x + 5$ from the sum of $-2x + 3$, $3x + 4$, and $3 - 2x$.

3. Expand and simplify.

a) $3(5y-2)$

b) $-5g(3-2g^2)$

c) $3y^2(1-y-2y^2)$

d) $3(x+4)-2(x+3)+5(2x-1)$

e) $3(x+4)-2\left[(x+3)+5(2x-1)\right]$

4. Expand and simplify.

a) $(x+6)(x-6)$ **b)** $(y+2)(y+4)$

c) $(x-4)(x+2)$ **d)** $(y-3)^2$

e) $(5a+2c)(3a-7c)$ **f)** $(2x+3y)(3y-4z)$

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

5. Expand and simplify.

a) $(x-3)(x-1)+(x+3)(x-2)$

b) $(x+3)(2x-5)+(4x+3)(3x-7)$

c) $(x+3)(2x-5)-(4x+3)(3x-7)$

d) $-(x-2)(x+3)-2(x+5)(x+1)$

e) $(k+2)^2+2(k-1)^2+(k-4)(2k+1)$

f) $(p-1)^2-(p-2)^2-p^2$

6. Expand and simplify.

a) $(a+b+c)^2$ **b)** $(3x+y+z)^2$

c) $(5-x-2y)^2$ **d)** $(1-x+x^2)(1+2x)$

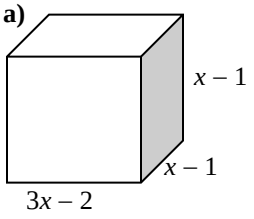
e) $(3z^2-5z+2)(2z-3)$

f) $(x+1)(x+2)(x+3)$

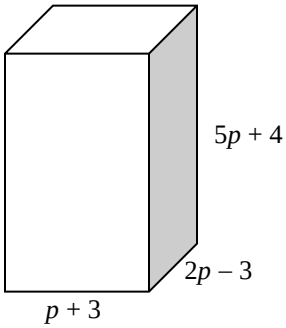
g) $(x+3y)(x+5y)(x+y)$

7. Write a simplified expression for the volumes of the solid shapes.

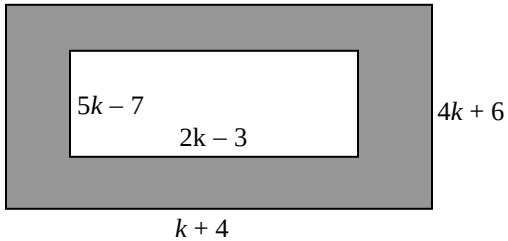
a)



b)



8. Write a simplified expression for the area of the shaded region.



Unit 1 – Lesson 2: Review of Factoring Part 1 (Common, Diff of Squares and Simple Trinomials)

Target: 1) I can factor using the methods: common factor, difference of squares, and simple trinomials
2) I can factor involving a combination of the three types

Part 1: **Common Factor**

a) the coefficient (numbers) → the largest number that divides evenly into all the polynomials coefficient

b) the variables (letters) → list any variables (letters) that are common to all polynomials terms and then choose the lowest exponent found

Amazing! Now how do I factor?

1. Find the greatest common factor and put it in front of the bracket
2. Divide each term in the polynomial by the greatest common factor to find the terms in the bracket

Example 1: Factor the following polynomials

a) $12x^2 + 18x$ b) $-8m^2n^3 – 16m^5n$ c) $8p(x – 5) – 3(x – 5)$

d) $9x(a – b) + 5(b – a)$ → *hint*: remember that $(b – a) = -(a – b)$

Part 2: **Factoring Simple Trinomials**

Step 1: Identify a simple trinomial → _____ terms, where a = _____

Step 2: Use product/sum to factor into two binomials

Example 2:

a) $x^2 + 7x + 10$ b) $a^2 – 6a + 8$ c) $m^2 – 5mn – 14n^2$

d) $w^2 – 12w – 45$ e) $-2m^2 - 8mn - 6n^2$ f) $-4q^2 – 12q + 112$

Part 3: **Difference of Squares**

1) Identify the expression as a difference of squares
   - $x^2 - 16$
   - $4x^2 - 16y^2$
   - $4x^2 - (3x + 7)^2$

2) Factor by
   i. Square root both terms if possible (ignore negative sign) (*hint: we may replace an expression with a letter to make it easier to look at)
   ii. Draw two set of brackets
   iii. In one set of brackets add the terms found in step i., in the second set of brackets subtract the terms found in step i. (*at this stage, we can replace the letter we used back with the expression we removed)

Example 3: Verify each is a difference square and factor if possible – remember to look for common factors first!

a) $x^2 - 25$ b) $16x^2 + 9$ c) $25a^2 - 36b^2$

d) $4x^2 - 49y^2$ e) $50x^2 - 98y^2$ f) $(x+2)^2 - 25$

Unit 1 – Lesson 3: Review of Factoring Part 2 (Factor by Grouping and Complex Trinomials)

Target: 1) I can factor using the following methods: complex trinomials and factor by grouping

Part 1: Factor by Grouping

Lesson: Part 1 - Factoring by Grouping

Example 1: Factor $9x^2 + 15x + 3x + 5$

Step 1: Common Factor

Step 2: Group the terms so each group has a Common Factor

Step 3: Common factor each group

Step 4: Factor by dividing out the binomial from each "term"

Example 2: a) Factor $8x^2 - 4x + 6x - 3$ by grouping

b) Factor $2xy + 4x + 3y + 6$ by grouping

Part 2: Factoring Complex Trinomials

Our goal today is to be able to go from a complex trinomial ($ax^2 + bx + c$, where $a \neq 1$) into two binomials

Step 1: Find two numbers which
1. multiply to a x c and 2. add to b

Step 2: Decompose (break up) your "b" to the two values found in *Step 1*

The rest is what we learned yesterday...

Step 3: Group the terms so each group has a Common factor

Step 4: Common factor each group

Step 5: Factor by dividing out the binomial from each "term"

Example 3: Factor $5x^2 + 28x - 12$

Step 1:

Step 2:

Step 3:

Step 4:

Step 5:

Example 4: Factor $-24x^2 + 10x + 4$

Remember: *Look for a common factor first*!

Example 5: Factor $8x^2 + 2x - 3$

Day 2 & 3 + hmwk. Day 2 – ★

Day 3 – Remaining questions

Review – Factoring

EXERCISES 2-2 Review – Factoring

A

1. Factor.
   ★a) $x^2 + 3x + 2$ ★b) $x^2 - 5x + 6$ c) $3x^2 + 7x + 2$
   d) $2x^2 + 3x + 1$ e) $2x^2 - 7x + 6$ f) $6x^2 - 19x + 10$

2. Factor.
   ★a) $x^2 + x - 6$ b) $3x^2 - 7x + 4$ c) $2x^2 + 9x + 10$
   d) $2x^2 - x - 15$ e) $4x^2 - 8x - 21$ f) $4x^2 - 17x + 15$

B

3. Factor.
   a) $5x^2 + 11x + 2$ b) $7y^2 - 22y + 3$ c) $3x^2 + 20x + 25$
   d) $6 + 19a + 10a^2$ e) $6u^2 - 11u - 10$ f) $6x^2 - 13x + 6$

4. Factor.
   a) $6x^2 + 3x - 3$ b) $6m^2 - 17m - 14$ c) $4 + 12a - 40a^2$
   d) $-60 + 30x^2 - 5x$ e) $40 - 38x + 6x^2$ f) $23y + 10y^2 + 12$

5. Factor fully.
   ★a) $x^2 + 6xy + 8y^2$ b) $6x^2 - 27xy - 15y^2$ c) $11mn + 3m^2n^2 + 6$
   d) $16h^2 - 9hk - 25k^2$ e) $4st + 14t^2 - 10s^2$ f) $6x^2y^2 - 22xy + 20$

6. Factor fully.
   a) $3p^2 - 19pq - 14q^2$ b) $2a^2 + 15ab - 8b^2$ c) $21a^2 - 25ab - 4b^2$
   d) $20x^2 - 42xy + 18y^2$ e) $-12p^2 - 8pq + 15q^2$ f) $10x^2 + 19xy + 6y^2$

7. Factor fully.
   a) $9x^4 + 12x^2 + 4$ b) $6x^4 - x^2 - 12$ c) $6m^4 + 4m^2n^2 - 2n^4$
   d) $10x^4y^4 - 21x^2y^2 - 10$ e) $6a^4 + 3a^2b^2 - 18b^4$ f) $10x^4 + 25x^2 - 60$

8. Factor fully.
   a) $-12p^4 + 14p^2q^2 + 40q^4$ b) $-15x^4 - 2x^2y^2 + 24y^4$
   c) $-3a^4 - 7a^2b^2 - 4b^4$ d) $25a^4 - 25a^2b^2 + 6b^4$
   e) $-21x^4 - 51x^2y^2 - 18y^4$ f) $16x^2y^2 - 4y^4 - 7x^4$

C

9. Factor.
   a) $8x^2(x + 1) + 2x(x + 1) - 3(x + 1)$
   b) $(a^2 - ab)^2 - 8b^2(a^2 - ab) + 12b^4$
   c) $3x^2(2x + 1) - 8xy(2x + 1) + 4y^2(2x + 1)$

10. Factor.
    a) $abx^2 + (an - bm)x - mn$ b) $3ax^2 + (ab + 6)xy + 2by^2$
    c) $mn^2x^4 - (3mn + n)ax^2 + 3a^2$ d) $12abx^2 + (8a^2 - 6b^2)xy - 4aby^2$

11. Factor.
    ★a) $x^4 + 2x^3y^2 - 3x^2y^4$ b) $4m^6 + 2m^4n^2 - 12m^2n^4$
    c) $a^2bx^4 - (a^2 - b^2)ax^2y^2 - a^2by^4$ d) $3m^2n^2x^2 - 2n^3x + 12m^3x - 8mn$

EXERCISES 2-3

A

★1. Factor.
   a) $b^2 - a^2$ b) $1 - 9b^2$ c) $81x^2 - 25$
   d) $49x^2 - y^2$ e) $4m^2 - 9$ f) $16p^2 - 49$

2. Factor.
   ★a) $x^2 + 2xy + y^2$ b) $9e^2 + 6e + 1$ c) $4x^2 - 20x + 25$
   d) $4m^2 + 12m + 9$ e) $9x^2 - 24x + 16$ f) $25x^2 - 20x + 4$

3. Factor.
   a) $ax - cy + bx - by$ b) $ax + by - bx - ay$
   c) $cx - dy + dx - cy$ d) $x^3 + x^2 + x + 1$
   e) $2xy + 4x + 3y + 6$ f) $6ab + 3a - 10b - 5$

4. Factor.

★ a) $m^2p^2 - 100a^2$ ★ b) $3 - 48x^2$ ★ c) $a^2x^2 - b^2y^2$
★ d) $(x + y)^2 - w^2$ ★ e) $y^4 - 81$ ★ f) $16x^4 - 625y^4$
g) $49p^2 - 42pc + 9c^2$ h) $1 - 20y^2z^2 + 100y^4z^4$ i) $d^3a^2 + 2d^3a + d^3$
j) $12m^2 - 36m + 27$ k) $18a^3 + 12a^2 + 2a$ l) $25x^4 - 20x^3y^2 + 4x^2y^4$

5. Factor.

★ a) $(2x - 1)^2 - y^2$ ★ b) $9m^2 - (5n - 1)^2$
c) $4a^2 - 9 - 2ab + 3b$ d) $x^2 - 9y^2 + x - 3y$
e) $x - a + (x - a)^2$ f) $4x^2 + 4xy + y^2 - 1$
g) $a^2 - b^2 + c^2 - 2ac$ h) $(5x + 2)^2 - 5xy - 2y$

6. Factor.

a) $ax - a + bx - b + cx - c$ b) $(x - b)^2 - c^2$
c) $x^3 + x^2 - 3x - 3$ d) $2y^3 + 5y - 4y^2 - 10$
e) $m^2 - 9 + 6n - n^2$ f) $6xy + 30x - 10y - 9x^2 - 25$
g) $25(x - 3y)^2 - 16(3x - y)^2$ h) $d(1 - r) - dr + dr^2$

7. Two perfect squares with a difference of 48 are 64 and 16. How many other pairs of perfect squares are there with a difference of 48? Can you prove that you have found them all?

★ 8. a) Show that $x^4 + x^2 + 1 = (x^2 + 1)^2 - x^2$.
b) Use the result of part a) to factor $x^4 + x^2 + 1$.

★ 9. Use the method suggested by *Exercise 8* to factor each expression.

a) $x^4 + x^2 + 25$ b) $x^4 - 3x^2 + 1$
c) $x^4 + 4$ d) $x^4 + x^2y^2 + y^4$

Exercises 2-2, page 46

1. a) $(x + 1)(x + 2)$ b) $(x - 3)(x - 2)$
c) $(3x + 1)(x + 2)$ d) $(2x + 1)(x + 1)$
e) $(2x - 3)(x + 2)$ f) $(3x - 2)(2x - 5)$
2. a) $(x + 3)(x - 2)$ b) $(3x - 4)(x - 1)$
c) $(2x + 5)(x + 2)$ d) $(2x + 5)(x - 3)$
e) $(2x + 3)(2x - 7)$ f) $(4x - 5)(x - 3)$
3. a) $(5x + 1)(x + 2)$ b) $(7y - 1)(y - 3)$
c) $(3x + 5)(x + 5)$ d) $(3 + 2a)(2 + 5a)$
e) $(2u - 5)(3u + 2)$ f) $(2x - 3)(3x - 2)$
4. a) $3(2x - 1)(x + 1)$ b) $(3m + 2)(2m - 7)$
c) $4(1 - 2a)(1 + 5a)$ d) $5(2x - 3)(3x + 4)$
e) $2(4 - 3x)(5 - x)$ f) $(5y + 4)(2y + 3)$
5. a) $(x + 2y)(x + 4y)$ b) $3(2x + y)(x - 5y)$
c) $(3mn + 2)(mn + 3)$ d) $(16h - 25k)(h + k)$
e) $2(7t - 5s)(t + s)$
f) $2(3xy - 5)(xy - 2)$
6. a) $(3p + 2q)(p - 7q)$ b) $(2a - b)(a + 8b)$
c) $(7a + b)(3a - 4b)$ d) $2(5x - 3y)(2x - 3y)$
e) $-(6p - 5q)(2p + 3q)$ f) $(5x + 2y)(2x + 3y)$
7. a) $(3x^2 + 2)^2$ b) $(3x^2 + 4)(2x^2 - 3)$
c) $2(3m^2 - n^2)(m^2 + n^2)$
d) $(5x^2y^2 + 2)(2x^2y^2 - 5)$
e) $3(2a^2 - 3b^2)(a^2 + 2b^2)$
f) $5(2x^2 - 3)(x^2 + 4)$
8. a) $-2(3p^2 + 4q^2)(2p^2 - 5q^2)$
b) $-(2y^2 - x^2)(2y^2 - 7x^2)$
c) $-(3a^2 + 4b^2)(a^2 + b^2)$
d) $(5a^2 - 2b^2)(5a^2 - 3b^2)$
e) $-3(7x^2 + 3y^2)(x^2 + 2y^2)$
f) $-(3x^2 + 4y^2)(5x^2 - 6y^2)$
9. a) $(x + 1)(2x - 1)(4x + 3)$
b) $(a - 3b)(a + 2b)(a - 2b)(a + b)$
c) $(2x + 1)(3x - 2y)(x - 2y)$
10. a) $(ax - m)(bx + n)$ b) $(ax + 2y)(3x + by)$
c) $(mnx^2 - a)(nx^2 - 3a)$
d) $2(2ax - by)(3bx + 2ay)$
11. a) $x^2(x - y^2)(x + y^2)$
b) $2m^2(2m^2 - 3n^2)(m^2 + 2n^2)$
c) $a(ax^2 + by^2)(bx^2 - ay^2)$
d) $(3m^2x - 2n)(n^2x + 4m)$

Exercises 2-3, page 48

1. a) $(b - a)(b + a)$ b) $(1 - 3b)(1 + 3b)$
c) $(9x - 5)(9x + 5)$ d) $(7x - y)(7x + y)$
e) $(2m + 3)(2m - 3)$ f) $(4p - 7)(4p + 7)$
2. a) $(x + y)^2$ b) $(3e + 1)^2$ c) $(2x - 5)^2$
d) $(2m + 3)^2$ e) $(3x - 4)^2$ f) $(5x - 2)^2$
3. a) $(x - y)(a + b)$ b) $(a - b)(x - y)$
c) $(x - y)(c + d)$ d) $(x + 1)(x^2 + 1)$
e) $(2x + 3)(y + 2)$ f) $(2b + 1)(3a - 5)$
4. a) $(mp + 10a)(mp - 10a)$
b) $3(1 - 4x)(1 + 4x)$
c) $(ax + by)(ax - by)$
d) $(x + y + w)(x + y - w)$
e) $(y^2 + 9)(y - 3)(y + 3)$
f) $(4x^2 + 25y^2)(2x + 5y)(2x - 5y)$
g) $(7p - 3c)^2$ h) $(1 - 10y^2z^2)^2$ i) $d^3(a + 1)^2$
j) $3(2m - 3)^2$ k) $2a(3a + 1)^2$
l) $x^2(5x - 2y^2)^2$
5. a) $(2x - 1 + y)(2x - 1 - y)$
b) $(3m - 5n + 1)(3m + 5n - 1)$
c) $(2a - 3)(2a + 3 - b)$
d) $(x - 3y)(x + 3y + 1)$
e) $(x - a)(1 + x - a)$
f) $(2x + y + 1)(2x + y - 1)$
g) $(a - c - b)(a - c + b)$
h) $(5x + 2)(5x + 2 - y)$
6. a) $(x - 1)(a + b + c)$
b) $(x - b + c)(x - b - c)$
c) $(x + 1)(x^2 - 3)$ d) $(y - 2)(2y^2 + 5)$
e) $(m - n + 3)(m + n - 3)$
f) $(3x - 5)(2y - 3x + 5)$
g) $(17x - 19y)(-7x - 11y)$ h) $d(1 - r)^2$
7. 121, 169, 49, 1
8. b) $(x^2 - x + 1)(x^2 + x + 1)$
9. a) $(x^2 - 3x + 5)(x^2 + 3x + 5)$
b) $(x^2 - x - 1)(x^2 + x - 1)$
c) $(x^2 - 2x + 2)(x^2 + 2x + 2)$
d) $(x^2 - xy + y^2)(x^2 + xy + y^2)$

EXERCISES 3-5

(A)

1. Factor:
   a) $4x^2 - 25$ b) $16m^2 - 81n^2$ c) $36a^2 - 121$
   d) $9s^2 - 49t^2$ e) $64x^2 - 169y^2$ f) $400a^2 - 81b^2$

2. Factor:
   a) $48a^2 - 147b^2$ b) $50m^3 - 18m$ c) $20x^3 - 405xy^2$
   d) $63a^3 - 112ab^2$ e) $100x^3y^2 - 324xy^4$ f) $54y - 384x^2y$

3. Factor:
   a) $x^4 - 81$ b) $12m^4 - 75n^4$ c) $32a^4 - 1250b^4$
   d) $9s^4t - \frac{1}{4}t^3$ e) $\frac{16}{25}x^2y^2 - \frac{36}{49}y^4$ f) $256x^8 - y^8$

4. Factor:
   a) $(5x - 2)^2 - 49$ b) $4m^2 - (6m - 7)^2$
   c) $16(3x - y)^2 - 81y^2$ d) $(2x - 7y)^2 - (3x + 2y)^2$
   e) $(5m + 2)^2 - (3m - 8)^2$ f) $9(2a + 5b)^2 - 4(7a - 3b)^2$

5. Factor:
   a) $(a^2 + 2a)^2 - 64$ b) $(2x^2 - 6x)^2 - 1296$
   c) $(2x^2 + 3xy)^2 - 4y^4$ d) $36n^4 - (3m^2 + 7mn)^2$
   e) $(a^2 - 13a)^2 - 900$ f) $2(x^2 - 10xy)^2 - 1152y^4$

6. Factor:
   a) $x^2 + 10x + 25$ b) $m^2 - 14m + 49$ c) $4a^2 + 12a + 9$
   d) $x^2 - 18xy + 81y^2$ e) $36x^2 + 132xy + 121y^2$

(B)

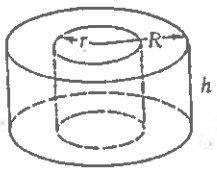
7. Factor:
   a) $49m^2 + 70m + 25$ b) $12a^2 - 108a + 243$
   c) $16s^2 + 88s + 121$ d) $-32x^2 + 48xy - 18y^2$
   e) $9m^2 - 60mn + 100n^2$ f) $45x^2 - 210xy + 245y^2$

8. Factor:
   a) $m^2 + 6m + 9 - n^2$ b) $4x^2 - 20x + 25 - 16y^2$
   c) $9a^2 - 12a + 4 - 49b^2$ d) $x^2 + 8xy + 16y^2 - 81$
   e) $4s^2 - 20st + 25t^2 - 9$ f) $25x^2 - 80x + 64 - 64y^2$

9. Factor:
   a) $a^2 - b^2 + 8bc - 16c^2$ b) $x^2 - y^2 - 14yz - 49z^2$
   c) $25 - m^2 - 12mn - 36n^2$ d) $4s^2 - 9t^2 - 12t - 4$
   e) $x^2 - a^2 - y^2 - 2ay$ f) $a^2 - 2a + 1 - b^2 + 2bc - c^2$

10. Factor:
    a) $x^2 + 9y^2 - 25z^2 - 6xy$ b) $9m^2 - 49p^2 - 4n^2 - 28np$
    c) $x^3 + x^2 - x - 1$ d) $a^2 + 2a + 1 - b^2 + 6b - 9$
    e) $a^{2n} - b^{2n}$ f) $2x^4 - 20x^2 + 18$

11. A cylinder of length h has outside radius R and inside radius r. Find an expression for the total surface area of the cylinder (including the ends) and write it as a product of algebraic factors.



$(5x+3)(5x+4)$ b) $(6x-1)(3x-4)$
$(35m+2)(21m-4)$
$(3a+3b+1)(2a+2b+5)$
$(8p+4q-3)(4p+2q-1)$
$(15x^2+10y+3)(6x^2+4y-7)$
$(x+4)(x-1)(x+1)(x+2)$
$(x+1)(x+3)(x+2)(x+2)$
$(a+3)(a-1)(a+1)(a+1)$
$(y-4)(y+2)(y-3)(y+1)$
$(2a+1)(a+2)(2a-3)(a+4)$
$(3x+4)(x-2)(3x-5)(x+1)$
$(x-y)(5x-3y)$ b) $(2m-n)(13m-5n)$
$3(a-1)(a+3)$ d) $(2x+y)(11x-5y)$
$2(3s+2t)(s+4t)$ f) $3(2x-5y)(3x-y)$
3 b) 5 c) 7 d) 9 e) 9 f) 13

) $(2x+1)(5x+8)$ b) $(2a-9)(4a-3)$
) $(3x+5y)(4x-15y)$ d) $(2+3t)(12-5t)$
) $6(x+5)(2x+3)$ b) $5(2x-7y)(5x+2y)$
) $9(3a-8b)(6a-5b)$ d) $8(4-7m)^2$
) $17(4x-1)(13x+18)$ b) $23(8x+5)(11x+13)$

cises 3-5, page 80

a) $(2x+5)(2x-5)$ b) $(4m+9n)(4m-9n)$
c) $(6a+11)(6a-11)$ d) $(3s+7t)(3s-7t)$
e) $(8x+13y)(8x-13y)$
f) $(20a+9b)(20a-9b)$
a) $3(4a+7b)(4a-7b)$
b) $2m(5m+3)(5m-3)$
c) $5x(2x+9y)(2x-9y)$
d) $7a(3a+4b)(3a-4b)$
e) $4xy^2(5x+9y)(5x-9y)$
f) $6y(3+8x)(3-8x)$
a) $(x^2+9)(x+3)(x-3)$
b) $3(2m^2+5n^2)(2m^2-5n^2)$
c) $2(2a+5b)(2a-5b)(4a^2+25b^2)$
d) $t\left(3s^2+\frac{1}{2}t\right)\left(3s^2-\frac{1}{2}t\right)$
e) $4y^2\left(\frac{2}{5}x+\frac{3}{7}y\right)\left(\frac{2}{5}x-\frac{3}{7}y\right)$
f) $(2x+y)(2x-y)(4x^2+y^2)(16x^4+y^4)$
a) $5(5x-9)(x+1)$ b) $(-4m+7)(8m-7)$
c) $(12x-13y)(12x+5y)$
d) $5(x-y)(-x-9y)$
e) $4(4m-3)(m+5)$
f) $(-8a+21b)(20a+9b)$
a) $(a+4)(a-2)(a^2+2a+8)$
b) $4(x-6)(x+3)(x^2-3x+18)$
c) $(2x-y)(x+2y)(2x^2+3xy+2y^2)$
d) $(3n+m)(2n-3m)(6n^2+7mn+3m^2)$
e) $(a-10)(a-3)(a+2)(a-15)$
f) $2(x-12y)(x+2y)(x-6y)(x-4y)$
6. a) $(x+5)^2$ b) $(m-7)^2$ c) $(2a+3)^2$
d) $(x-9y)^2$ e) $(6x+11y)^2$
7. a) $(7m+5)^2$ b) $3(2a-9)^2$ c) $(4s+11)^2$
d) $-2(4x-3y)^2$ e) $(3m-10n)^2$
f) $5(3x-7y)^2$
8. a) $(m+3-n)(m+3+n)$
b) $(2x-5-4y)(2x-5+4y)$
c) $(3a-2-7b)(3a-2+7b)$
d) $(x+4y-9)(x+4y+9)$
e) $(2s-5t+3)(2s-5t-3)$
f) $(5x-8+8y)(5x-8-8y)$
9. a) $(a-b+4c)(a+b-4c)$
b) $(x-y-7z)(x+y-7z)$
c) $(5-m-6n)(5+m+6n)$
d) $(2s+3t+2)(2s-3t-2)$
e) $(x-a-y)(x+a+y)$
f) $(a+b-c-1)(a-b+c-1)$
10. a) $(x-3y-5z)(x-3y+5z)$
b) $(3m-2n-7p)(3m+2n+7p)$
c) $(x+1)^2(x-1)$ d) $(a-b+4)(a+b-2)$
e) $(a^n+b^n)(a^n-b^n)$
f) $2(x+1)(x+3)(x-1)(x-3)$
11. $2\pi(R+r)(R-r+h)$
12. a) $A=\pi^2(a-b)(a+b)$
b) About 1.48×10^6 m^2
13. $kx(2T+x)(2T^2+2Tx+x^2)$
14. a) i) 6 ii) Not possible
b) Those values for which $2m-1$ is prime.

Exercises 3-6, page 82

1. a) $(z-3)(z^2+3z+9)$ b) $(y+1)(y^2-y+1)$
c) $8(x-2)(x^2+2x+4)$
d) $(a-2b)(a^2+2ab+4b^2)$
e) $(2x+3y)(4x^2-6xy+9y^2)$
f) $(4x+1)(16x^2-4x+1)$
2. a) $x(x^2+3x+3)$ b) $(2x+1)(4x^2-2x+1)$
c) $2(3x^2+6x+4)$
d) $(2x+2y+1)(4x^2+4y^2-4xy+4x-2y+1)$
e) $4b(3a^2+4b^2)$ f) $2x(x^2+3y^2)$
g) $2x(x^2+27)$
3. a) $(x+y)(x-y)(x^4+x^2y^2+y^4)$
b) $(x^2+y^2)(x^4-x^2y^2+y^4)$
c) $(2a-1)(2a+1)(16a^4+4a^2+1)$
c) $(1+4y^2)(1-4y^2+16y^4)$
e) $4xy(x^2+3y^2)(y^2+3x^2)$
f) $2(x^2+y^2)(x^4+14x^2y^2+y^4)$
4. a) $V=\frac{1}{3}\pi h(a^2+ab+b^2)$
b) When $b=a$, $V=\frac{1}{3}\pi h(a^2+a^2+a^2)$, or πa^2h

Exercises 3-7, page 86

1. a) $\frac{8m}{5n}$ b) $\frac{-5b^2}{8ac}$ c) $\frac{t^2}{3s}$ d) $\frac{-5x}{8y}$ e) $\frac{5m^5}{2n^3}$
f) $\frac{3x^2}{5}$

Unit 1 – Lesson 4: Simplifying Rational Functions (start of Grade 11U Math!)

Target: 1) I can define a rational expression
2) I can simplify a rational expression and state the appropriate restrictions
3) I understand what a restriction is

Steps to simplifying Rational *Expressions*:

1. **FULLY factor numerator and denominator**

Example 1:

a) $\frac{7x-14y}{2x-4y}$ b) $\frac{x+3}{x^2+10x+21}$ c) $\frac{4x^2-4x-3}{4x^2-9}$

2. **State any restrictions**

Aside: We can never divide by _____. If we divide by _____, our answer becomes undefined.

Stating restrictions:
If a variable is in the denominator, there may be restrictions on its possible value. Normally, we say that a variable can be any real number, but i.e.

$\frac{3}{x}$, if x = _____, the expression is undefined, therefore we say $x \neq$ _____

Example 2: State the restrictions of the following FUNctions:

a) $\frac{5}{x+1}, x \neq$ b) $\frac{7}{(x+1)(x-2)}, x \neq$ c) $\frac{9}{(2x+1)(3x-2)}, x \neq$

3. Simplify expression by dividing out common factors

Example 3:

a) $\frac{7(y-2x)}{2(y-2x)}$ b) $\frac{x+3}{(x+3)(x+7)}$ c) $\frac{(2x+1)(2x-3)}{(2x-3)(2x+3)}$

Restrictions:

Putting it together:

Example 4: Simplify. State any restrictions on the variables

a) $\frac{3x^2-21x}{7x^2-28x+21}$ b) $\frac{x^2+7x-8}{2-2x}$

Unit 1 – Lesson 5: Multiplying/Dividing Rational Expressions

Target: I can multiply and divide rational expressions and simplify their answers with restrictions

Try things we do know:

Example 1: $\frac{3}{2} \times \frac{4}{5}$

Example 2: $\frac{3}{2} \div \frac{4}{5}$

Example 3: $\frac{6x^2}{5xy} \times \frac{15xy^3}{8xy^4}$

How to Multiply Rational Expressions

Step 1:Factor numerators and denominators (if possible)

Step 2:State any restrictions from the denominators

Step 3:Cancel any factors common in the numerator and denominator

Step 4:Multiply the numerators, multiply the denominators

Example 4: $\frac{x^2-4}{x^2+12x+36} \times \frac{x^2+9x+18}{4-2x}$

How to Multiply Rational Expressions

Step 1:Factor numerators and denominators (if possible)

Step 2:State any restrictions from the denominators

Step 3:Cancel any factors common in the numerator and denominator

Step 4:Multiply the numerators multiply the denominators, write as a single rational expression

Example 5: $\frac{10x^2+3xy-y^2}{9x^2-y^2} \div \frac{6x^2+3xy}{12x+4y}$

How to Divide Rational Expressions

Step 1:Factor numerators and denominators

Step 2:State any restrictions from the denominators and numerator of the divisor

Step 3: Multiply by the reciprocal of the divisor

Step 4:Cancel any factors common in the numerator and denominator

Step 5:Multiply the numerators multiply the denominators, write as a single rational expression

Unit 1 – Lesson 6: Adding/Subtracting Rational Expressions Part I

Target: 1) I can find the LCD given 2 or more rational expressions (with and without variables)
2) I can add and subtract monomials and basic rational expressions with simple factoring and provide restrictions

Warm up: Simplify and state the restrictions of: $\frac{(2x+5y)^2}{3x-4y} \times \frac{16x^2-9y^2}{4x^2-25y^2} \div \frac{3x+4y}{2x-5y}$

Find the lowest common multiple (LCM) of:

a) 8 and 6

b) 8, 12 & 16

c) $10x^3$ and $4x^2$

d) 3a, 4b and $6a^2b$

e) $8xy^2$, $10x^3y$ and $12x^2$

The procedure for adding and subtracting rational functions are the same as those for adding and subtracting rational numbers. When rational expressions are added or subtracted, they have a _____ _____.

Example 1:
Simplify and state any restrictions on the variables:

a) $\frac{2x}{3} - \frac{5y}{8}$

b) $\frac{-3}{2x} + \frac{11}{6x^2}$

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

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

Unit 1 – Lesson 7: Adding/Subtracting Rational Expressions Part II

Target: 1) I can add and subtract rational expressions with complex factoring and provide restrictions
2) I can add/subtract and multiply rational expressions and consider BEDMAS when doing so

Warm up: Simplify. State any restrictions on the variables

a) $\frac{1}{2x} - \frac{7}{3x^2} + \frac{4}{x^3}$

b) $\frac{6x}{x^2-5x+6} - \frac{3x}{x^2+x-12}$

I can add and subtract rational expressions with complex factoring; factoring in the numerator and denominator.

Example 1: Simplify and state restrictions

$$\frac{x^2-4x+3}{x^2-16} + \frac{4-3x}{3x-12}$$

Example 2: Simplify and state restrictions

$$\frac{2x}{x^2-6x+9} - \frac{3}{x^2+2x-15} + \frac{x}{x^2-25}$$

Example 3: Simplify and state restrictions (remember BEDMAS!)

$$\frac{x^2+5x+6}{x^2-3x+2} \div \frac{x+3}{x-1} - \frac{6}{x+3}$$

ADDING & SUBTRACTING RATIONAL EXPRESSIONS PRACTICE

1. $\frac{x-4}{3}+\frac{5x}{3}$
2. $\frac{2x+5}{7}-\frac{x}{7}$
3. $\frac{8}{x}+\frac{x+9}{x}$
4. $\frac{3x-8}{4x}+\frac{-x+8}{4x}$
5. $\frac{3x-6}{24x}+\frac{3x+6}{24x}$
6. $\frac{2x+3}{x+5}-\frac{x-3}{x+5}$
7. $\frac{2x+3}{x+4}-\frac{x-7}{x+4}$
8. $\frac{8}{3(x+8)}+\frac{4}{3(x+8)}$
9. $\frac{3}{2(x-9)}+\frac{9}{2(x-9)}$
10. $\frac{7}{3(x-1)}+\frac{5}{3(x-1)}$
11. $\frac{4x+7}{x+5}-\frac{x-6}{x+5}$
12. $\frac{-2x+1}{x^2-4}-\frac{-3x-1}{x^2-4}$
13. $\frac{5x+1}{x^2-64}-\frac{4x-7}{x^2-64}$
14. $\frac{2x^2+7x-3}{x^2+4x-12}-\frac{2x^2+6x-1}{x^2+4x-12}$
15. $\frac{3x-4}{x^2-5x+4}+\frac{3-2x}{x^2-5x+4}$
16. $\frac{5x-4}{x^2-6x-7}+\frac{5-4x}{x^2-6x-7}$
17. $\frac{3x-8}{x^2-9}-\frac{2x-5}{x^2-9}$
18. $\frac{4x-7}{x^2-25}-\frac{3x-2}{x^2-25}$
19. $\frac{2}{3x}+\frac{4}{x}$
20. $\frac{6}{x}+\frac{7}{5x^2}$
21. $\frac{3}{x}+\frac{6}{7x^2}$
22. $\frac{4}{x}+\frac{7}{6x^2}$
23. $\frac{6}{5x^3y}-\frac{1}{2x^2y^3}$
24. $\frac{5}{xy}+\frac{7}{2x^2}$
25. $2x+\frac{x}{y}$
26. $\frac{5x-3}{4x}-\frac{1}{6x}$
27. $\frac{7}{3x}-\frac{4}{5x^2}$
28. $\frac{5}{x}+8$
29. $7-\frac{4}{x-9}$
30. $\frac{x-1}{x-2}-\frac{x^2+4x-4}{x^2+4x-12}$
31. $\frac{x+2}{x-6}-\frac{x^2+5x+14}{x^2-2x-24}$
32. $\frac{x+2}{x-7}-\frac{x^2+4x+13}{x^2-4x-21}$
33. $\frac{x-4}{x^2+5x+6}+\frac{x-1}{x^2-4}$
34. $\frac{x-4}{x^2+4x+3}-\frac{x-1}{x^2-9}$
35. $\frac{x-4}{x^2+3x+2}+\frac{x+3}{x^2-4}$
36. $-\frac{x-2}{x^2-2x-8}-\frac{x-1}{x^2-4}$
37. $\frac{x+5}{x^2+3x-4}+\frac{x+2}{x^2-1}$
38. $\frac{x+1}{x^2+6x+9}+\frac{x-4}{x^2-9}$
39. $\frac{3x-1}{x^2+2x-3}-\frac{x+4}{x^2-9}$
40. $\frac{3x-2}{x^2+2x-24}-\frac{x-3}{x^2-16}$
41. $\frac{2}{x^2-5x+4}+\frac{-2}{x^2-4}$
42. $\frac{3}{x^2-7x+6}+\frac{-3}{x^2-9}$
43. $3+\frac{x}{x+2}-\frac{2}{x^2-4}$
44. $2+\frac{x}{x-3}-\frac{3}{x^2-9}$
45. $\frac{1}{x+1}-\frac{x}{x-2}+\frac{x^2+2}{x^2-x-2}$
46. $\frac{2}{x+3}-\frac{x}{x-1}+\frac{x^2+2}{x^2+2x-3}$
47. $\frac{4x}{x^2-1}+\frac{3x}{1-x}-\frac{4}{x-1}$
48. $\frac{5x}{1-2x}-\frac{2x}{2x+1}+\frac{3}{4x^2-1}$
49. $\frac{1}{x^2+5x+6}-\frac{2}{x^2+3x+2}+\frac{1}{x^2-3x-4}$
50. $\frac{2}{x^2-5x+6}-\frac{4}{x^2-2x-3}+\frac{2}{x^2+4x+3}$

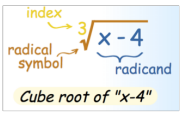
PRACTICE ANSWERS

1. $\frac{6x-4}{3}$
2. $\frac{x+5}{7}$
3. $\frac{x+17}{x}$
4. $\frac{1}{2}$
5. $\frac{1}{4}$
6. $\frac{x+6}{x+5}$
7. $\frac{x+10}{x+4}$
8. $\frac{4}{x+8}$
9. $\frac{6}{x-9}$
10. $\frac{4}{x-1}$
11. $\frac{3x+13}{x+5}$
12. $\frac{1}{x-2}$
13. $\frac{1}{x-8}$
14. $\frac{1}{x+6}$
15. $\frac{1}{x-4}$
16. $\frac{1}{x-7}$
17. $\frac{1}{x+3}$
18. $\frac{1}{x+5}$
19. $\frac{14}{3x}$
20. $\frac{30x+7}{5x^2}$
21. $\frac{21x+6}{7x^2}$
22. $\frac{24x+7}{6x^2}$
23. $\frac{12y^2-5x}{10x^3y^3}$
24. $\frac{10x+7y}{2x^2y}$
25. $\frac{2xy+x}{y}$
26. $\frac{15x-11}{12x}$
27. $\frac{35x-12}{15x^2}$
28. $\frac{8x+5}{x}$
29. $\frac{7x-67}{x-9}$
30. $\frac{1}{x+6}$
31. $\frac{1}{x+4}$
32. $\frac{1}{x+3}$
33. $\frac{2x^2-4x+5}{(x+2)(x-2)(x+3)}$
34. $\frac{13-7x}{(x+1)(x-3)(x+3)}$
35. $\frac{2x^2-2x+11}{(x+2)(x-2)(x+1)}$
36. $\frac{-2x^2+9x-8}{(x-4)(x-2)(x+2)}$
37. $\frac{2x^2+12x+13}{(x-1)(x+1)(x+4)}$
38. $\frac{-x+9}{(x+3)^2(x-3)}$
39. $\frac{2x^2-13x+7}{(x+3)(x-1)(x-3)}$
40. $\frac{2x^2+7x+10}{(x+6)(x+4)(x-4)}$
41. $\frac{10x-16}{(x-4)(x-1)(x+2)(x-2)}$
42. $\frac{21x-45}{(x-6)(x-1)(x+3)(x-3)}$
43. $\frac{4x^2-2x-14}{(x+2)(x-2)}$
44. $\frac{3x^2-3x-21}{(x+3)(x-3)}$
45. 0
46. $\frac{-x}{(x+3)(x-1)}$
47. $\frac{-3x^2-3x-4}{(x+1)(x-1)}$
48. $\frac{-14x^2-3x+3}{(2x+1)(2x-1)}$
49. $\frac{4x+26}{(x+3)(x+2)(x+1)(x-4)}$
50. $\frac{-6x+42}{(x-3)(x-2)(x+1)(x+3)}$

Unit 1 – Lesson 8: Radicals (Part 1)

Targets:
1. I will be able to convert mixed and entire radicals
2. I will be able to add/subtract radicals with and without like bases
3. I will be able to multiply radicals

Definition: A radical is an expression that has a square root, cube root, etc.



1. Fill in the following radicals:

a) $\sqrt{\_\_} = 1$ b) $\sqrt{\_\_} = 2$ c) $\sqrt{\_\_} = 3$ d) $\sqrt{\_\_} = 4$

e) $\sqrt{\_\_} = 5$ f) $\sqrt{\_\_} = 6$ g) $\sqrt{\_\_} = 7$ h) $\sqrt{\_\_} = 8$

i) $\sqrt{\_\_} = 9$ j) $\sqrt{\_\_} = 10$ k) $\sqrt{\_\_} = 11$ j) $\sqrt{\_\_} = 12$

2. Complete:

$\sqrt{25}\times\sqrt{4} =$ $\sqrt{25\times4} =$

$\sqrt{16}\times\sqrt{9} =$ $\sqrt{16\times9} =$

$\sqrt{100}\times\sqrt{6} =$ $\sqrt{100\times6} =$

$\sqrt{144}\times\sqrt{14} =$ $\sqrt{144\times14} =$

Therefore, if *a* and *b* are both positive whole numbers $\sqrt{a}\times\sqrt{b} =$

Entire radical: a radical with a coefficient of ____. For example:

Mixed radical: a radical with coefficient other than _____. For example:

3. Complete:

$4\sqrt{6}\times2\sqrt{4} =$ $8\sqrt{24} =$

$-4\sqrt{3}\times8\sqrt{13} =$ $-32\sqrt{39} =$

Therefore, if *a* and *b* are both positive whole numbers $x\sqrt{a}\times y\sqrt{b} =$

4. Converting from an entire radical to a mixed radical

Simplify and express each of the following as a mixed radical in *lowest terms*
→ find the factors which include the greatest perfect square first.

a) $\sqrt{72}$ b) $-6\sqrt{27}$ c) $\sqrt{2}\times\sqrt{10}$

d) $\sqrt{2}\times\sqrt{6}\times\sqrt{3}$ e) $4\sqrt{3}\times3\sqrt{6}$ f) $2\sqrt{5}\times-3\sqrt{10}$

Review: Adding like terms → 6x + 8x – 9x =

Does this work for radicals as well?

Try → Calculate and find the decimal number:

$3\sqrt{5}+7\sqrt{5}=$ and $10\sqrt{5}=$

$-6\sqrt{7}+5\sqrt{7}+8\sqrt{7}=$ and $7\sqrt{7}=$

but:

$\sqrt{3}+\sqrt{5}=$ and $\sqrt{8}=$

Therefore, if *a* is a positive whole number, $x\sqrt{a}+y\sqrt{a}=$, but $\sqrt{a}+\sqrt{b}\neq$

Simplify

a) $\sqrt{27}+\sqrt{48}=$ b) $8\sqrt{7}+2\sqrt{28}=$ c) $3\sqrt{48}-4\sqrt{8}+4\sqrt{27}=$

Unit 1 – Lesson 9: Radicals (Part 2)

Targets:
1. I will be able to multiply and multiply radicals expressions
2. I will be able to expand and simplify radical binomials

Dividing Radicals:

Recall: $\sqrt{a}\times\sqrt{b} = \sqrt{ab} \rightarrow$ so, $\frac{\sqrt{a}}{\sqrt{b}} =$

1. Simplify, write as a single radical

a) $\frac{\sqrt{25}}{\sqrt{5}}$ b) $\frac{-16\sqrt{75}}{8\sqrt{3}}$ c) $\frac{-30\sqrt{40}}{5\sqrt{18}}$

d) $\frac{48\sqrt{96}}{12\sqrt{27}}$

Multiplying Binomial Radical expressions:

2. Simplify

a) $(3-\sqrt{6})(2+\sqrt{24})$

Step 1: simplify by expanding the quantities in brackets
Step 2: Simplify all terms (if possible)
Step 3: Collect and combing like terms

b) $(3\sqrt{3}+4\sqrt{2})(\sqrt{3}-2\sqrt{2})$

c) $(1-\sqrt{3})(2+\sqrt{6})(5+\sqrt{2})$

Rationalizing:

Rationalizing is the process by which a fraction is rewritten so that the denominator contains only rational numbers.

$ex\ 1.\ \frac{2}{\sqrt{3}}$

$ex\ 2.\ \frac{2+\sqrt{5}}{\sqrt{8}}$

Rationalizing by multiplying the denominator by the "conjugate". A **math conjugate** is formed by changing the sign between two terms in a binomial. For instance, the **conjugate** of x + y is x - y. We can also say that x + y is **a**conjugate of x - y.

$ex\ 3.\ \frac{3}{2+\sqrt{3}}$

$ex\ 4.\ \frac{-2}{\sqrt{5}-2}$

Unit 1 Lesson 8 – Radicals

Homework: do: #1-4(acd), 5cde, 6, 12, 15ab, 16

CHECK YOUR Understanding

1. Express each of these as mixed radicals in simplest form.
   a) $\sqrt{27}$ c) $\sqrt{98}$
   b) $\sqrt{50}$ d) $\sqrt{32}$

2. Simplify.
   a) $\sqrt{5} \times \sqrt{7}$ c) $2\sqrt{3} \times 5\sqrt{2}$
   b) $\sqrt{11} \times \sqrt{6}$ d) $-4\sqrt{3} \times 8\sqrt{13}$

3. Simplify.
   a) $4\sqrt{5} + 3\sqrt{5}$ c) $3\sqrt{3} + 8\sqrt{2} - 4\sqrt{3} + 11\sqrt{2}$
   b) $9\sqrt{7} - 4\sqrt{7}$ d) $\sqrt{8} - \sqrt{18}$

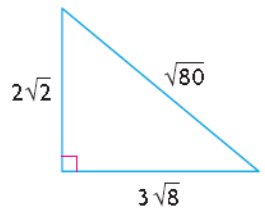
PRACTISING

4. Express as a mixed radical in simplest form.
   a) $3\sqrt{12}$ c) $10\sqrt{40}$ e) $\frac{2}{3}\sqrt{45}$
   b) $-5\sqrt{125}$ d) $-\frac{1}{2}\sqrt{60}$ f) $-\frac{9}{10}\sqrt{1200}$

5. Simplify.
   a) $\sqrt{3}(2 - \sqrt{5})$ d) $(-2\sqrt{3})^3$
   b) $2\sqrt{2}(\sqrt{7} + 3\sqrt{3})$ e) $4\sqrt{3} \times 3\sqrt{6}$
   c) $(4\sqrt{2})^2$ f) $-7\sqrt{2} \times 5\sqrt{8}$

6. Simplify.
   a) $\sqrt{8} - \sqrt{32}$
   b) $\sqrt{12} + \sqrt{18} - \sqrt{27} + \sqrt{50}$
   c) $3\sqrt{98} - 5\sqrt{72}$
   d) $-4\sqrt{200} + 5\sqrt{242}$
   e) $-5\sqrt{45} + \sqrt{52} + 3\sqrt{125}$
   f) $7\sqrt{12} - 3\sqrt{28} + \frac{1}{2}\sqrt{48} + \frac{2}{3}\sqrt{63}$

12. Calculate the perimeter and area of this triangle.



15. Express each radical in simplest radical form.
   a) $\sqrt{a^3}$ c) $5\sqrt{n^7} - 2n\sqrt{n^5}$
   b) $\sqrt{x^5y^6}$ d) $(\sqrt{p} + 2\sqrt{q})(\sqrt{q} - \sqrt{p})$

16. Simplify $\sqrt{\sqrt{\sqrt{4096}}}$.

Answers:

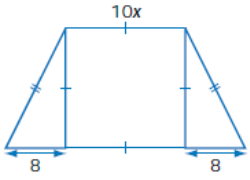
1. a) $3\sqrt{3}$ b) $5\sqrt{2}$ c) $7\sqrt{2}$ d) $4\sqrt{2}$
2. a) $\sqrt{35}$ b) $\sqrt{66}$ c) $10\sqrt{6}$ d) $-32\sqrt{39}$
3. a) $7\sqrt{5}$ b) $5\sqrt{7}$ c) $-\sqrt{3} + 19\sqrt{2}$ d) $-\sqrt{2}$
4. a) $6\sqrt{3}$ c) $20\sqrt{10}$ e) $2\sqrt{5}$
   b) $-25\sqrt{5}$ d) $-\sqrt{15}$ f) $-18\sqrt{3}$
5. a) $2\sqrt{3} - \sqrt{15}$ c) 32 e) $36\sqrt{2}$
   b) $2\sqrt{14} + 6\sqrt{6}$ d) $-24\sqrt{3}$ f) -140
6. a) $-2\sqrt{2}$ c) $-9\sqrt{2}$ e) $2\sqrt{13}$
   b) $-\sqrt{3} + 8\sqrt{2}$ d) $15\sqrt{2}$ f) $16\sqrt{3} - 4\sqrt{7}$
7. a) $18 + 12\sqrt{10} - 3\sqrt{5} - 10\sqrt{2}$
   b) $31 + 12\sqrt{3}$
   c) -3
   d) $-7 - 2\sqrt{6}$
   e) $83 - 12\sqrt{35}$
   f) $4 + 3\sqrt{6} - 8\sqrt{3} - 13\sqrt{2}$
8. $4\sqrt{2}$ cm
9. $15\sqrt{2}$ cm
10. $3\sqrt{10}$ cm
11. $6\sqrt{2}$
12. Perimeter $= 8\sqrt{2} + 4\sqrt{5}$, Area $= 12$

15. a) $a\sqrt{a}$
    b) $x^2y^3\sqrt{x}$
16. $2\sqrt{2}$

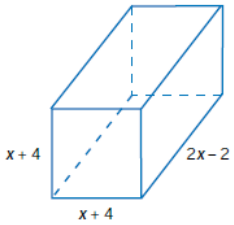
Application Problems Chapter 1

1. For a cube of edge length x, find the ratio of the volume to the surface area. Simplify, if possible.

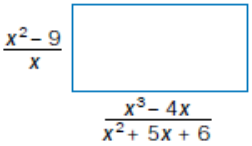
2. Find the ratio of the area of the square to the area of the trapezoid. Simplify, if possible.



3. Find the ratio of the volume to the surface area for the rectangular prism shown. Simplify, if possible.

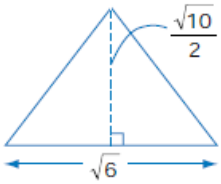


4. Write the area of the rectangle in simplest form.



5. Two triangles have the same base length, represented by x. The height of one triangle is x + 1. The height of the other is x + 3. Write and simplify an expression that represents the total area of the two triangles.

6. Express the exact area of the triangle in simplest radical form.

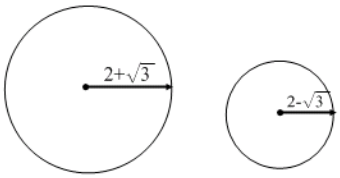


7. There are many variations on the game of chess. Most played are played on square boards that consist of a number of small squares. However, some variations do not use the familiar 64-square board.

a) If each small square on a grand chess board is 2 cm by 2 cm, each diagonal of the whole board measures $\sqrt{800}$ cm. How many small squares are on the board?

b) A Japanese version of the game is called Chu Shogi. If each small square On this board measures 3 cm by 3 cm, each diagonal of the whole board will be $\sqrt{2592}$ cm. How many squares are on the board?

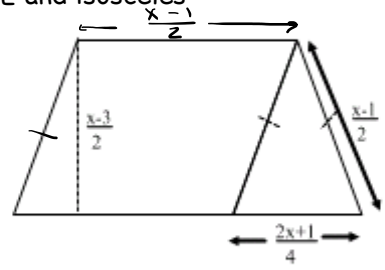
8. Express the ratio of the area of the larger circle to the area of the smaller circle in simplest radical form.



9. Simplify each of the following:

a) $\sqrt[3]{16}$ b) $\sqrt[3]{32}$ c) $\sqrt[3]{54}$ d) $\sqrt[3]{81}$

10. The diagram shows a trapezoid ABCD divided into a rhombus ABCE and isosceles triangle ADE.



a) Write an expression for the area of the triangle in terms of x.
b) Write an expression for the area of the rhombus in terms of x.
c) Add and simplify part a) and b)
d) Write and simplify an expression that represents the longer base of the trapezoid in terms of x.
e) Write a simplified formula for the area of the trapezoid in terms of x.
(leave in factored form)

Answers:

1. $\frac{x^3}{6x^2} = \frac{x}{6}, x \geq 0$ 2. $\frac{5x}{5x+4}, x \geq 0$ 3. $\frac{(x+4)(x-1)}{5x}, x \geq 1$ 4. $x^2 - 5x + 6$

5. $x(x+2)$ 6. $\frac{\sqrt{15}}{2}$ 7. a) 100 b) 144 8. $97 + 56\sqrt{3}$

9. a) $2\sqrt[3]{2}$ b) $2\sqrt[3]{4}$ c) $3\sqrt[3]{2}$ d) $3\sqrt[3]{3}$

10. a) $\frac{(2x+1)(x-3)}{16}$ b) $\frac{(x-1)(x-3)}{4}$ c) $\frac{3(2x-1)(x-3)}{16}$ d) $\frac{4x-1}{4}$ e) $\frac{3(2x-1)(x-3)}{16}$