4.1 REVIEW: Estimating Roots

NC 4.1 Concepts: #5, 6

TEST: Find $\sqrt{20}$ on your calculator.

- In this section, we will review how to estimate square roots and learn how to estimate cube and fourth roots. We will also learn about the different terms and "parts" of roots.

Question: What is the connection or relationship between a square root and squaring a number?

To calculate 3^4, you will need to use one of the following on your calculator:

- 3 ^ 4
- 3 y^x 4
- 3 x^y 4

Or use (3)(3)(3)(3)

$3^2 = 9 \quad and \quad \sqrt{9} = 3$

What type of root would have the same relationship with cubing a number?

$3^3 = 27 \quad and$ ______________

What type of root would have the same relationship with finding the fourth power of a number?

$3^4 = 81 \quad and$ ______________

To the power 2 (Squared)	To the Power 3 (Cubed)	To the Power 4	To the Power 5
$2^2 = 4$ $\therefore\rightarrow$	$2^3 = 8$ $\therefore\rightarrow$	$2^4 = 16$ $\therefore\rightarrow$	$2^5 = 32$ $\therefore\rightarrow$
$3^2 = 9$	$3^3 = 27$	$3^4 = 81$	$3^5 = 243$
$4^2 = 16$	$4^3 = 64$	$4^4 = 256$	$4^5 = 1024$
$5^2 = 25$	$5^3 = 125$	$5^4 = 625$	$5^5 = 3125$
$6^2 = 36$	$6^3 = 216$	$6^4 = 1296$	$6^5 = 7776$
$7^2 = 49$	$7^3 = 343$	$7^4 = 2401$	$7^5 = 16807$
$8^2 = 64$	$8^3 = 512$	$8^4 = 4096$	$8^5 = 32768$
$9^2 = 81$	$9^3 = 729$	$9^4 = 6561$	$9^5 = 59049$
$10^2 = 100$	$10^3 = 1000$	$10^4 = 10000$	$10^5 = 100000$
$11^2 = 121$	$11^3 = 1331$	$11^4 = 14641$	$11^5 = 161051$
$12^2 = 144$	$12^3 = 1728$	$12^4 = 20736$	$12^5 = 248832$
$13^2 = 169$	$13^3 = 2197$	$13^4 = 28561$	$13^5 = 371293$
$14^2 = 196$	$14^3 = 2794$	$14^4 = 38416$	$14^5 = 537824$
$15^2 = 225$	$15^3 = 3375$	$15^4 = 50625$	$15^5 = 759375$
$16^2 = 256$	$16^3 = 4096$	$16^4 = 65536$	$16^5 = 1048576$
$17^2 = 289$	$17^3 = 4913$	$17^4 = 83521$	$17^5 = 1419857$
$18^2 = 324$	$18^3 = 5832$	$18^4 = 104976$	$18^5 = 1889568$
$19^2 = 361$	$19^3 = 6859$	$19^4 = 130321$	$19^5 = 2476099$
$20^2 = 400$	$20^3 = 8000$	$20^4 = 160000$	$20^5 = 3200000$
$21^2 = 441$	$21^3 = 9261$	$21^4 = 194481$	$21^5 = 4084101$
$22^2 = 484$	$22^3 = 10648$	$22^4 = 234256$	$22^5 = 5153632$
$23^2 = 529$	$23^3 = 12167$	$23^4 = 279841$	$23^5 = 6436343$

Terminology For Radicals:

The little number outside and to the left of the radical sign is called the INDEX.

$\sqrt[n]{x}$

The number/term inside the radical sign is called the RADICAND

Example #1: Without using a calculator, find the exact value or approximate/estimated value of the following:

a) $\sqrt{4}$ b) $\sqrt{9}$ c) $\sqrt{5}$

Example #2: Without using a calculator, find the exact or approximate values of the following:

$\sqrt{22}$

Example #3: Without using a calculator, find the exact value of the following roots:

a) $\sqrt{\frac{16}{25}}$ b) $\sqrt[4]{16}$ c) $\sqrt{0.81}$ d) $\sqrt[3]{0.027}$

Example #4: Without using a calculator, find the exact or approximate values of the following:

a) $\sqrt{0.0049}$ b) $\sqrt[3]{0.000216}$ c) $\sqrt[3]{\frac{0.008}{0.125}}$ d) $\sqrt{0.85}$

Example #5: Given the number 5, write it in equivalent form as:

a) a square root b) a cube root

c) a fourth root d) a fifth root

Example #6: Using your calculator, find the following answers:

a) $\sqrt{-9}$ b) $\sqrt{-25}$ c) $\sqrt[3]{-8}$ d) $\sqrt[3]{-125}$

e) $\sqrt[4]{-16}$ f) $\sqrt[4]{-81}$ g) $\sqrt[5]{-32}$ h) $\sqrt[5]{-243}$

Explain how you can predict which answers won't have a solution…….

Finding Roots with Negative Radicands

If you have a negative radicand with an even index, the answer will be _______________

If you have a negative radicand with an odd index, the answer will be _________________

NO CALCULATORS ALLOWED!!!

4.1 *FA (Foundational Assignment) (All C6)
P206 #1, 2, 3, 5

4.1 MLA (Mid-Level Assignment) (All C6)
P206 # 4, 6

NC 4.1 Assignments for Concepts #6

NO CALCULATORS

4.2 Irrational Numbers

NC 4.2 Concepts: #5

Online Video Lesson: http://goo.gl/JKczok

The Number Story:

Rational Numbers:

- A Rational Number is a number that can be written as a fraction where the denominator is not zero.
- $\frac{m}{n}$, m and n are integers, $n \neq 0$ is the form of a rational number
- If they are divided and written as decimals, the decimals of a rational number will always terminate/end or will repeat
- All the numbers on the table on page 1 that are perfect square roots, perfect cube roots, perfect fourth roots and perfect fifth roots will have rational number answers to their "roots".

Irrational Numbers:

- An Irrational Number is a number that **can't** be written as a fraction where the numerator and denominator are integers. Instead, irrational numbers are always decimals. The decimals of irrational numbers never terminate/end nor do they ever repeat.
- If we take the square, cube, fourth or fifth root of numbers not found in the table on page one (except for numbers further down the list that aren't shown), the answers to their roots will be irrational numbers.
- NOTE: Calculators have a limited number of spots for decimals. If you use a calculator to find a root and the decimals fill the screen and don't repeat or have a repeating pattern, it is more than likely that the answer is an irrational number.

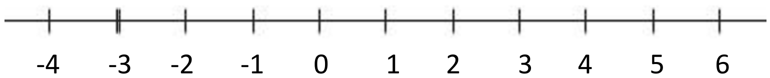
Example #1: Identify the following as rational numbers or irrational numbers.

a) 6   b) $\frac{5}{7}$ c) $\sqrt{45}$ d) $\sqrt[3]{8}$ d) $\sqrt[4]{25}$

e) $\sqrt{\frac{9}{121}}$ f) $\sqrt[5]{243}$ e) $\sqrt{-36}$ f) $\sqrt[3]{-125}$

Example #3: Use the estimation skills we used in 4.1 to estimate each of the following. Use the number line to order the following numbers from least to greatest.

$\sqrt{18}, \sqrt[3]{-30}, \sqrt[3]{27}$



Example #4: To which subset(s) of numbers do the following belong?

a) 5   b) -7   c) 3/8   d) -7.2   e) $\sqrt{7}$

Example #5: State a number (different than the ones in example 5) that is

a) real and irrational   b) real and natural

c) real and a whole number   d) real and rational

- What answer can you have in c that you can't have in b?
- What answer can you have in d that you can't have in b and c?

NO CALCULATORS ALLOWED!!!

4.2 *FA (Foundational Assignment) All C5
P211 #3, 4, 7, 8, 10, 11, 14, 15

4.2 MLA (Mid-Level Assignment) (All C5)
P211 #6, 13, 16, 17, 20

4.2 ULA (Upper Level Assignment)
P211 #21-24

NC 4.2 Assignments
for Concepts #5

NO CALCULATORS

4.3A Mixed and Entire Radicals

NC 4.3A Concept: #6

Online Video Lesson: http://goo.gl/k2MIHB

OUTCOME FP10.2 Part B: Students will demonstrate understanding of irrational numbers in radical (including mixed radical) form

Example #1: Simplify the following radicals (simplify means you are not allowed to use the $\sqrt{\ }$ *or* $\sqrt[3]{\ }$ buttons on your calculator or get any decimal answers)

a) $\sqrt{8}$

b) $\sqrt[3]{54}$

c) $\sqrt{75}$

d) $\sqrt[4]{243}$

How to Simplify Roots: Method 1 (using the table on P1)

1. Find the appropriate column (square roots are in column 1, cube roots in column 2 etc)
2. Remember that all the numbers to the right of the equal sign are perfect numbers (perfect square #'s in column 1, perfect cube #'s in column 2 etc). Find the largest perfect number in your column that will evenly divide into your radical.
3. Write your radical as the perfect # times the other number. Put these under the root sign.
4. Find the root of the perfect number. This number will be a rational number and will no longer be in a root sign. Write it down. After it, write down the root that still contains the "other number".

Example #2: Simplify the following radicals using the Prime factorization method.

a) $\sqrt{99}$

b) $\sqrt[3]{189}$

How to Simplify Roots: Method (using Prime Factorization)
NOTE – this works well for large radicands

1. Break down the number in the root (the radicand) into it's prime factors.
2. If you have a square root, try and write your prime factors as a list of pairs. Put extra numbers that aren't pairs at the end.
3. The square root answer of each "pair" will just be one of the numbers in the pair. This number will not be written in a root. Do this for each pair. Put each number you get outside the root in a bracket. Leave all numbers that aren't pairs inside the root.
4. Multiply all numbers in brackets together outside the root. Multiply all numbers together that are left in the root. These two numbers are your simplified answer.
5. If you have a cube root, you need to try and list your prime factors as triples. The square root of a triple is just one of the numbers in the triple. The rest of the steps are the same.
6. If you have a fourth root you need to list your prime factors as groups of four. The square root of a group of four of the same number is just one of the numbers. The rest of the steps are the same.

c) $\sqrt[4]{18144}$

NO CALCULATORS ALLOWED!!!

4.3A *FA (Foundational Assignment) All C6
P218 #4, 10, 11, 17

4.3A MLA (Mid-Level Assignment) (All C6)
P218 #9, 14, 15, 16,

NC 4.3A Assignments for Concepts #6

NO CALCULATORS

4.3B Mixed and Entire Radicals Cont.

NC 4.3B Concept: #6

Online Video Lesson: **http://goo.gl/u5sgQc**

OUTCOME FP10.2 Part B: Students will demonstrate understanding of irrational numbers in radical (including mixed radical) form

Example #1: Write each mixed radical as an entire radical. Translation: turn this radical back into what it used to be before someone simplified it!

a) $2\sqrt{6}$

b) $3\sqrt{5}$

c) $2\sqrt[3]{5}$

d) $2\sqrt[4]{7}$

How to Change a Mixed Radical to an Entire Radical

1. Identify the index (small number outside the root)
2. Take the number outside the radical and put it inside the radical – but repeat it as many times as the index is.
3. Multiply all the numbers inside the radical together.

Entire Radical – The radical before it is simplified in the form $\sqrt{b}$

Mixed Radical - The radical after it has been simplified in the form $a\sqrt{b}$ (No decimals)

Example #2: Arrange in order from greatest to least without using a calculator.

$8\sqrt{5},\ 6\sqrt{2},\ 7\sqrt{15},\ 2\sqrt{9},\ \sqrt{17}$

NO CALCULATORS ALLOWED!!!

4.3B *FA (Foundational Assignment) All C6
P218 #5, 12, 18

4.3B MLA (Mid-Level Assignment) (All C6)
P218 # 13, 20, 22, 24

NC 4.3B Assignments for Concepts #6

NO CALCULATORS

4.4 Fractional Exponents and Radicals

NC 4.4 Concept: #8

Online Video Lessons:

http://goo.gl/UXaq7U **http://goo.gl/G6RVwM** **http://goo.gl/zO4Mg4**

In this section, we will learn how Fractional Exponents relate to Radicals.

OUTCOME FP10.2 Part A: Students will demonstrate understanding of irrational numbers in exponent form with numerical bases

Fractional Exponent/Radical Chart

1. Square roots can also be written using an exponent of $\frac{1}{2}$. This means that $\sqrt{x} = x^{\frac{1}{2}}$
2. Cube roots can also be written using an exponent of $\frac{1}{3}$. This means that $\sqrt[3]{x} = x^{\frac{1}{3}}$
3. Fourth roots can also be written using an exponent of $\frac{1}{4}$. This means that $\sqrt[4]{x} = x^{\frac{1}{4}}$
4. Fifth roots can also be written using an exponent of $\frac{1}{5}$. This means that $\sqrt[5]{x} = x^{\frac{1}{5}}$

In general, $\sqrt[n]{x} = x^{\frac{1}{n}}$

Example #1: Evaluate the following without using a calculator.

a) $16^{\frac{1}{2}}$ b) $(-64)^{\frac{1}{3}}$ c) $16^{\frac{1}{4}}$ d) $0.0049^{\frac{1}{2}}$

Example #2: Change into radical form and use your calculator to find the value of each to two decimal places.

a) $7^{\frac{1}{2}}$ b) $24^{\frac{1}{3}}$ c) $\sqrt[3]{120}$ d) $\sqrt[4]{68}$

Fractional Exponents with Numerators Greater Than One/Radical Chart

In our previous questions, the numerator of the fractional exponent was 1. Technically, what we actually should have seen for each root was the following: $x^{\frac{1}{2}} = \sqrt{x^1} \ or \ \left(\sqrt{x}\right)^1$, $x^{\frac{1}{3}} = \sqrt[3]{x^1} \ or \ \left(\sqrt[3]{x}\right)^1$ etc with the number "1" from the numerator appearing as shown. Because anything to the power 1 is itself, writing the 1 was unnecessary. If the numerator is larger than 1, it is necessary to show the number. We will use the following rule to simplify radical with numerators larger than 1:

1. $x^{\frac{m}{2}} = \sqrt{x^m} \ or \ \left(\sqrt{x}\right)^m$ 2. $x^{\frac{m}{3}} = \sqrt[3]{x^m} \ or \ \left(\sqrt[3]{x}\right)^m$ 3. $x^{\frac{m}{4}} = \sqrt[4]{x^m} \ or \ \left(\sqrt[4]{x}\right)^m$

In general, $x^{\frac{m}{n}} = \sqrt[n]{x^m} \ or \ \left(\sqrt[n]{x}\right)^m$

Example #3: Write each power as a radical in two different ways.

a) $15^{\frac{5}{2}}$ b) $82^{\frac{2}{3}}$

Example #4: Write as a power with a fractional exponent.

a) $\sqrt[3]{5^2}$ b) $\left(\sqrt[4]{7}\right)^3$

Example #5: Evaluate the following without using a calculator.

a) $16^{\frac{3}{4}}$ b) $27^{\frac{2}{3}}$ c) $\left(0.0049\right)^{\frac{3}{2}}$

Example #6: Write as a radical and use a calculator to evaluate the following to two decimal places.

a) $\sqrt[3]{6^5}$

b) $\left(\sqrt[5]{4}\right)^2$

c) $6^{\frac{3}{4}}$

e) $(-2)^{\frac{2}{3}}$

f) $(-3)^{\frac{5}{2}}$

g) $\left(\sqrt{7}\right)^5$

Example #7: Change the following exponents from decimal form to fraction form and evaluate. Do not use your calculator!

a) $16^{0.25}$

c) $9^{1.5}$

NO CALCULATORS ALLOWED!!!

4.4 *FA (Foundational Assignment) All C7
P227 #3-8odd letters, 10-14odd letters

4.4MLA (Mid-Level Assignment) (All C7)
P227 #15, 16 (If needed also do even letters 3-8 & 10-14)

4.4 ULA (Upper Level Assignment)
P 227 #17-21

NC 4.4 Assignments for Concepts #7

NO CALCULATORS

4.5 Negative Exponents and Reciprocals

NC 4.5 Concept: #8

Online Video Lesson: **http://goo.gl/RBSGV7**

In this section, we will learn how to work with Negative Exponents.
OUTCOME FP10.2 Part A: Students will demonstrate understanding of irrational numbers in exponent form with numerical bases

Folding Activity:

Negative Exponents

When we are given a question with negative exponents, we need to change them to positive exponents before we can evaluate or simplify the radical. Here is the rule for changing a negative exponent to a positive exponent:

Examples:

$$3^{-5} = \frac{3^{-5}}{1} = \frac{1}{3^{+5}} = \frac{1}{3^{5}}$$

and

$$\frac{1}{4^{-3}} = \frac{4^{+3}}{1} = 4^{3}$$

and

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

and

$$\frac{1}{7^{-\frac{1}{2}}} = \frac{7^{+\frac{1}{2}}}{1} = 7^{\frac{1}{2}}$$

1. First, make sure the question itself is a fraction (the exponent does not have to be a fraction but the "big" number does). Put your original term over 1 if it is not a fraction.
2. The number that has the negative exponent needs to be moved to the opposite part of the fraction (top to bottom, bottom to top). Once you move it there, the exponent becomes positive. The exponent stays exactly the same except changes sign!!!!!
3. If the bottom of your fraction is now 1, you can remove it. If the top of the fraction is 1, it needs to stay!

In general: $x^{-n} = \dfrac{1}{x^{n}}$ *and* $\dfrac{1}{x^{-n}} = x^{n}$

Example #1: Write the following with positive exponents and evaluate.

a) 5^{-3}

b) 1000^{-2}

c) $\dfrac{1}{3^{-4}}$

Example #2: Evaluate each power (even though it does not say to change to positive exponents, you ALWAYS MUST do this first!)

a) $16^{-\frac{1}{2}}$ b) $(-8)^{-\frac{1}{3}}$ c) $27^{-\frac{2}{3}}$

Negative Exponents when the Base Number is a Fraction

1. First, give the negative exponent to both the number in the numerator and the number in the denominator.
2. Move each number to make the exponent of both numbers positive.
3. Perform the exponential operation on the term in the numerator and the term in the Denominator.
4. Simplify your result (if possible)

$$\left(\frac{2}{5}\right)^{-3} = \frac{(2)^{-3}}{(5)^{-3}} = \frac{5^3}{2^3} = \frac{125}{8}$$

In general: $\left(\frac{a}{b}\right)^{-n} = \frac{b^n}{a^n}$ *or* $\left(\frac{a}{b}\right)^{-\frac{m}{n}} = \frac{b^{\frac{m}{n}}}{a^{\frac{m}{n}}}$

Example #3: Evaluate each power.

a) $\left(\frac{1}{3}\right)^{-4}$ b) $\left(\frac{2}{3}\right)^{-3}$ c) $\left(\frac{4}{9}\right)^{-\frac{3}{2}}$

NO CALCULATORS ALLOWED!!!

4.5 *FA (Foundational Assignment) All C8
P233 #3, 5, 6ac, 7, 8, 9, 10

4.5 MLA (Mid-Level Assignment) (All C8)
P233 #4, 11, 13

4.5 ULA (Upper Level Assignment)
P 233 #14, 15, 16

NC 4.5 Assignments for Concepts #8

NO CALCULATORS

4.6A Applying the Exponent Laws

NC 4.6A Concept: #9

Online Video Lesson: **http://goo.gl/lhlKcw**

In this section, we will apply the exponent laws to simplify expressions.

OUTCOME FP10.2 Part A: Students will demonstrate understanding of irrational numbers in exponent form with numerical bases

Review of Exponent Laws

1. When two powers with the same base are multiplied, add the exponents.

$$\boxed{(a^m)(a^n) = a^{m+n}}$$

ex: $(2^5)(2^7) = 2^{5+7}$
$= 2^{12}$
$= 4096$

2. When two powers with the same base are divided, subtract the exponents.

$$\boxed{\frac{a^m}{a^n} = a^{m-n}}$$

ex: $\frac{3^8}{3^5} = 3^{8-5}$
$= 3^3$
$= 27$

3. When you are taking a "power of a power", multiply the exponents.

$$\boxed{\left(a^m\right)^n = a^{(m)(n)}}$$

ex: $(2^3)^2 = 2^{3 \times 2}$
$= 2^6$
$= 64$

4. When you are taking a "power of a product", give the exponent to each product.

$$\boxed{(ab)^m = (a^m)(b^m)}$$

ex: $[(2)(5)]^3 = (2^3)(5^3)$
$= (8)(125)$
$= 1000$

5. When you are taking a "power of a quotient (division)", give the exponent to both the numerator and denominator.

$$\boxed{\left(\frac{a}{b}\right)^n = \frac{(a^n)}{(b^n)}}$$

ex: $\left(\frac{2}{3}\right)^4 = \frac{2^4}{3^4}$
$= \frac{16}{81}$

Negative Exponents

Questions always need to be left with answers that only contain positive exponents.

Example #1: Simplify each expression by writing it as a power with a positive exponent.

a) $\left(3^{-7}\right)\left(3^{3}\right)$

b) $\left(5^{-7}\right)^{2}\left(5^{-2}\right)^{3}$

c) $\dfrac{\left(6^{-8}\right)\left(6^{4}\right)}{\left(6^{-3}\right)}$

d) $\left(2^{-4}\right)\left(2^{-3}\right)$

e) $\left(3^{-2}\bullet 3^{4}\right)^{-2}$

f) $\dfrac{11^{-2}}{11^{-4}\bullet 11^{-5}}$

g) $\left[\left(\dfrac{2}{3}\right)^{3}\right]^{-2}$ (evaluate as well!)

Example #2: Simplify the following.

a) $\dfrac{2}{5}-\dfrac{3}{8}$

b) $\dfrac{7}{6}+\dfrac{1}{18}$

c) $-\dfrac{4}{15}-\dfrac{2}{9}$

Example #3: Simplify each expression by writing it as a power with a positive exponent.

a) $3^{\frac{1}{2}}\cdot 3^{\frac{1}{4}}$

b) $2^{-\frac{1}{3}}\bullet\left(2^{-2}\right)^{\frac{1}{2}}$

c) $\dfrac{\left(5^{-0.5}\right)\left(5^{1.5}\right)}{5^{0.5}}$

d) $\left(4^{\frac{1}{2}} \bullet 4^{-\frac{1}{4}}\right)^3$

e) $\left[\left(-\frac{4}{5}\right)^2\right]^{-3} \div \left[\left(-\frac{4}{5}\right)^4\right]^{-5}$

f) $\dfrac{9^{\frac{5}{4}} \bullet 9^{-\frac{1}{4}}}{9^{\frac{3}{4}}}$

NO CALCULATORS ALLOWED!!!

4.6A *FA (Foundational Assignment) All C9
P241 #4, 7, 10

4.6A MLA (Mid-Level Assignment) (All C9)
P241 #12, 13

NC 4.6A Assignments for Concepts #9

NO CALCULATORS

4.6B Cont. - Applying the Exponent Laws cont.

NC 4.6B Concept: #9

In this section, we will apply the exponent laws to simplify expressions that contain variables.
OUTCOME FP10.2 Part B: Students will demonstrate understanding of irrational numbers in exponent form with variable bases

Example #1: Simplify. Leave all variables with positive exponents and evaluate all coefficients (numbers in front of the variables)

a) $3a^2 \cdot a^{-5} \cdot a^4$

b) $\left(2x^2 \cdot 3x^{-5}\right)^3$

c) $\dfrac{12a^{2}}{3a^{-3}}$

d) $x^{\frac{3}{2}} \cdot x^{-1}$

e) $\dfrac{10a^{\frac{9}{4}}}{8a^{3}}$

f) $m^{4}n^{-2} \cdot m^{2}n^{3}$

g) $\dfrac{6x^{4}y^{-3}}{14xy^{2}}$

h) $\left(25a^{4}b^{2}\right)^{\frac{3}{2}}$

i) $\left(x^{3}y^{-\frac{3}{2}}\right)\left(x^{-1}y^{\frac{1}{2}}\right)$

j) $\dfrac{12x^{-5}y^{\frac{5}{2}}}{3x^{\frac{1}{2}}y^{-\frac{1}{2}}}$

k) $\left(\dfrac{50x^{2}y^{4}}{2x^{4}y^{8}}\right)^{\frac{1}{2}}$

NO CALCULATORS ALLOWED!!!

4.6B *FA (Foundational Assignment) All C9
241 #3ac, 4, 6bc, 8,11ad, 14

4.6B MLA (Mid-Level Assignment) (All C8)
P241 #16, 19, 21

NC 4.6B Assignments for Concepts #9

NO CALCULATORS

List of Foundational Assignments for Each Concept in This Topic

Concept 5 FA: P211 #3, 4, 7, 8, 10, 11, 14, 15
Concept 6 FA: P206 #1, 2, 3, 5 and P218 #4, 10, 11, 17
Concept 7 FA: P227 #3-8odd letters, 10-14odd letters
Concept 8 FA: P233 #3, 5, 6ac, 7, 8, 9, 10
Concept 9 FA P241 #4, 7, 10 and P241 #3ac, 4, 6bc, 8,11ad, 14

Midlevel for Concept 5: P211 #6, 13, 16, 17, 20
Midlevel for Concept 6: P206 # 4, 6 and P218 #9, 14, 15, 16
Midlevel for Concept 7: P227 #15, 16 (If needed also do even letters 3-8 & 10-14)
Midlevel for Concept 8: P233 #4, 11, 13
Midlevel for Concept 9: P241 #12, 13 and P241 #16, 19, 21