PreCalculus UNIT A – part 3

ALGEBRA – journal questions (mostly MCR)

Summarize everything you need to know about these topics. Use examples and concise (not long – but with enough detail) explanations. Include definitions and diagrams if necessary

1. EXPONENT LAWS of Gr 10 (MPM)

Cut/Paste the following into your journal. Each row of questions requires more than just a final answer, so as you paste each row in your journal provide space for more work. You will need to show steps and then explain the rule as you go (maybe even state key words to say to yourself as you apply these rules).

EXPONENT RULES of Gr10

$a^0 = 1, a \neq 0$ $\quad a^n a^m = a^{n+m}$ $\quad \frac{a^n}{a^m} = a^{n-m} = \frac{1}{a^{m-n}}$

$(a^n)^m = a^{n \cdot m}$ $\quad (ab)^n = a^n b^n$ $\quad \left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

$a^{-n} = \frac{1}{a^n}$ $\quad \frac{1}{a^{-n}} = a^n$ $\quad \left(\frac{a}{b}\right)^{-n} = \left(\frac{b}{a}\right)^n = \frac{b^n}{a^n}$

EXPONENT RULES of Gr11

$\sqrt[m]{a} = a^{\frac{1}{m}}$ $\quad a^{\frac{n}{m}} = \sqrt[m]{a^n}$ $\quad$ if n is odd, $\sqrt[n]{a^n} = a$

$\sqrt[m]{ab} = \sqrt[m]{a}\sqrt[m]{b}$ $\quad \sqrt[m]{\frac{a}{b}} = \frac{\sqrt[m]{a}}{\sqrt[m]{b}}$ $\quad$ if n is even, $\sqrt[n]{a^n} = |a|$

if $a \neq 1$, $a^x = a^y \Leftrightarrow x = y$

if $x \neq 0$, $a^x = b^x \Leftrightarrow a = b$

Zero exponents

A. 6^0

B. -5^0 *Discuss what happens with negative if there's no brackets around it. Compare and contrast -5^0 and $(-5)^0$*

C. $6(7)^0$

Negative exponents

D. 2^{-2}

E. -6^{-2} *Compare and contrast -6^{-2} and $(-6)^{-2}$*

F. $2x^{-1}$ *Compare and contrast $2x^{-1}$ and $(2x)^{-1}$*

G. $\frac{3}{2^{-4}}$

Multiplication rule

H. $(2^3)(2^5)$

I. $7x^4(2x)$

J. $2x^3(2^4x^{-1})$

Division rule

K. $\frac{4x^6}{2x^2}$

L. $\frac{3^5 x^{10}}{3x^4}$

M. $\frac{4^3 x^2}{4^2 x^{-6}}$

Power of power rule

N. $(6^2)^3$

O. $(2x^4)^3$

P. $\left(\frac{7^2 x}{2y^3}\right)^3$

Common mistakes to discuss

Q. why $(2 \bullet 3)^2 = 2^2 \bullet 3^2$ but $(2+3)^2 \neq 2^2 + 3^2$

R. why $2 \bullet 3^x \neq 6^x$ but $2^x \bullet 3^x = 6^x$

2. RADICALS (MCR)

a. Discuss COMMON MISTAKE with powers and roots ie. why $\sqrt{25 \bullet 9} = 5 \bullet 3$ but $\sqrt{25 - 9} \neq 5 - 3$

b. Explain and show how to reduce Square roots

$\sqrt{32x^2y^3}$

c. Explain and show how to reduce Cube roots

$\sqrt[3]{16x^5y^3}$

d. Adding and Subtracting radicals

$5\sqrt{50} - 3\sqrt{18} + 6\sqrt{20}$

Put in this note:
If radicands match can combine coefficients:
$2\sqrt{3} + 5\sqrt{3} = 7\sqrt{3}$ but keep radical part the same and do not do the following $2\sqrt{3} + 5\sqrt{3} \neq 7\sqrt{6}$

e. Multiplying & Dividing Roots

$\frac{25\sqrt{3} \bullet 2\sqrt{30}}{\sqrt{5}}$

Put in notes:

If bases match you can combine exponents: $3^1 \bullet 3^{\frac{1}{2}} = 3^{\frac{3}{2}}$ but don't forget to keep the base the same, not like: $3^1 \bullet 3^{\frac{1}{2}} \neq 9^{\frac{3}{2}}$

If powers match can combine bases but keep power the same:
$2^{\frac{1}{2}} \bullet 3^{\frac{1}{2}} = 6^{\frac{1}{2}}$ but really make sure powers DO match: $2 \bullet 3^{\frac{1}{2}} \neq 6^{\frac{1}{2}}$

f. Rationalizing the denominator with Monomial denominator

$\frac{2}{3\sqrt{5}}$

g. Rationalizing the denominator with Binomial denominator

$\frac{2}{2 - 3\sqrt{5}}$

3. **EXPONENT LAWS of Gr11** (MCR)

Switch forms from radical to exponential			Switch forms from exponential to radical		
a. $\sqrt[4]{2x^5}$ *Compare and contrast* $\sqrt[4]{2x^5}$ *and* $\sqrt[4]{(2x)^5}$	b. $\sqrt{16x^7}$	c. $\sqrt[3]{(3a)^5}$	d. $6^{\frac{2}{7}}$	e. $125^{-\frac{1}{3}}$	f. $-121^{\frac{1}{2}}$ *Compare and contrast* $-121^{1/2}$ *and* $(-121)^{1/2}$
Simplify, record answers with positive exponents			Explain the last 4 rules of Gr11 that are circled in cut/paste of #1 using the following examples		
g. $\dfrac{\left(-2xy^3\times 3x^{-3}y^{-2}\right)^3}{6x^0y^{-1}}$	h. $\left(8x^6y^9\right)^{\frac{1}{3}}\left(27x^{-12}y^6\right)^{-\frac{1}{3}}$		i. $\sqrt[5]{x^5}$	j. $\sqrt[4]{x^4}$	k. $3^4=3^x$	l. $x^7=2^7$

4. **NOTES about ROOTS** (MCR)

Explain why you must:

a. Insert absolute values	b. Insert restriction	c. Do nothing (no restriction, no absolute value)	d. Do nothing
$\sqrt[6]{x^{18}}=x^{\frac{18}{6}}$ $=\lvert x\rvert^3$	$\sqrt[4]{x^{13}}=x^{\frac{13}{4}}=x^{\frac{12}{4}}x^{\frac{1}{4}}$ $=x^3\sqrt[4]{x},\quad x\geq 0$	$\sqrt[5]{x^7}=x^{\frac{7}{5}}=x^{\frac{5}{5}}x^{\frac{2}{5}}$ $=x\sqrt[5]{x^2}$	$\sqrt{x^4}=x^{\frac{4}{2}}$ $=x^2$

When done explanations add a few more examples of your own in each category above.

e. Go back to #2b of this journal and discuss what you'd change about your final answer.

5. **SOLVE EQUATIONS**

Solve for exponents (MPM + MCR)			Solve for base with rational exponent on it (MPM)
a. $80=16\left(\frac{2}{3}\right)^x-1$	b. $\left(\frac{9}{4}\right)^{2x-5}=\left(\frac{3}{2}\right)^x\left(\frac{243}{32}\right)$	c. $6^x=\dfrac{1}{16}$ *Show trial and error method here*	d. $2x^{\frac{4}{5}}+12=174$

e. Solve root equation, talk about extraneous solutions at the end $\sqrt{2x+5}+\sqrt{x+2}=5$ (AP)

POWER

BASE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	4	8	16	32	64	128	256	512	1,024	2,048	4,096	8,192	16,384	32,768	65,536	131,072	262,144	524,288	1,048,576
3	3	9	27	81	243	729	2,187	6,561	19,683	59,049	177,147	531,441	1,594,323							
4	4	16	64	256	1,024	4,096	16,384	65,536	262,144											
5	5	25	125	625	3,125	15,625	78,125	390,625												
6	6	36	216	1,296	7,776	46,656	279,936													
7	7	49	343	2,401	16,807	117,649	823,543													
8	8	64	512	4,096	32,768	262,144														
9	9	81	729	6,561	59,049	531,441														
10	10	100	1,000	10,000	100,000	1,000,000														
11	11	121	1,331	14,641	161,051															
12	12	144	1,728	20,736	248,832															
13	13	169	2,197	28,561	371,293															
14	14	196	2,744	38,416	537,824															
15	15	225	3,375	50,625	759,375															
16	16	256	4,096	65,536																
17	17	289	4,913	83,521																
18	18	324	5,832	104,976																
19	19	361	6,859	130,321																
20	20	400	8,000	160,000																
21	21	441	9,261	194,481																
22	22	484	10,648	234,256																
23	23	529	12,167	279,841																
24	24	576	13,824	331,776																
25	25	625	15,625	390,625																
26	26	676	17,576	456,976																
27	27	729	19,683	531,441																
28	28	784	21,952	614,656																
29	29	841	24,389	707,281																
30	30	900	27,000	810,000																