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Math Review (http://goo.gl/rTQmcL)
Essential Academic Skill Enhancement (EASE) workshop series

Essential Academic Skills Enhancement

STEM GATEWAY

This workshop reviews the basics of algebra through pre-calculus to help prepare you for college calculus.

We will discuss:

- Rational Equations
- Radical Equations
- Simple Exponents
- Not-So-Simple Exponents
- Quadratic Equations
- Trigonometry
- Composite Functions

SURVEY
http://goo.gl/4AD3OC

Assessment Set 1:

1. Rational Equations: $\frac{3}{x+2} - \frac{1}{x} = \frac{1}{5x}$ (hint: make the common denominator of $5x(x+2)$).
   - $\left(\frac{3}{x+2}\right)\left(\frac{5x}{5x}\right) - \left(\frac{1}{x}\right)\left(\frac{5(x+2)}{5(x+2)}\right) = \left(\frac{1}{5x}\right)\left(\frac{x+2}{x+2}\right)$
   - $\left(\frac{15x}{5x(x+2)}\right) - \left(\frac{5x+10}{5x(x+2)}\right) = \frac{x+2}{5x(x+2)}$
   - $15x - (5x + 10) = x + 2$
   - $10x - 10 = x + 2$
   - $9x = 12$
   - **$x = {}^{12}/_{9} = {}^{4}/_{3}$**

2. Radical Equations: $\sqrt{9x^2 + 4} = 3x + 2$
   - $\left(\sqrt{9x+4}\right)^2 = (3x+2)^2$
   - $9x^2 + 4 = (3x+2)(3x+2)$
   - $9x^2 + 4 = 9x^2 + 12 + 4$
   - $0 = 12x$
   - **$0 = x$**

3. Simple Exponents: $3^{2x-1} = 27$ (hint: What can you do to 27 to make it have base 3?)
   - $3^{2x-1} = 27$
   - $3^{2x-1} = 3^3$
   - $2x - 1 = 3$
   - $2x = 4$
   - **$x = 2$**

4. Not-So-Simple Exponents: $3(2^{x+4}) = 350$ (hint 1: Isolate the variable first; hint 2: Use natural log because of calculator function)
   - $2^{x+4} = \frac{350}{3}$
     (Note: 350/3 is not solved out because of rounding, it is best to keep it in fraction form until plugging in to the calculator)
   - $\ln(2^{x+4}) = \ln\left(\frac{350}{3}\right)$
   - $(x+4)\ln(2) = \ln\left(\frac{350}{3}\right)$
   - $x + 4 = \frac{\ln\left(\frac{350}{3}\right)}{\ln(2)}$
   - **$x = \frac{\ln\left(\frac{350}{3}\right)}{\ln(2)} - 4 = = 2.866$**

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5. Quadratic Equations: $2x^2 - 4x - 3 = 0$; Round answer to 2 decimal places.

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

- $x = \frac{-(-4)\pm\sqrt{(-4)^2-4(2)(-3)}}{2(2)}$
- $x = \frac{4\pm\sqrt{16+24}}{4} = \frac{4\pm\sqrt{40}}{4} = \frac{4\pm\sqrt{4}\sqrt{10}}{4}$
- $x = \frac{4\pm2\sqrt{10}}{4} = \frac{2(2\pm\sqrt{10})}{2(2)} = \frac{2\pm\sqrt{10}}{2}$
- $x = \frac{2-\sqrt{10}}{2}$ AND $x = \frac{2+\sqrt{10}}{2}$
- **$x \approx -0.58$ AND $x \approx 2.58$**

6. Trigonometry: $cos^2(x) + \cos(x) = sin^2(x)$ (hint: Use the trigonometric identity to have only 1 trig function: $sin^2(t) + cos^2(t) = 1$)

- $cos^2(x) + cos(x) = sin^2(x)$
- $cos^2(x) + cos(x) = 1 - cos^2(x)$
- $2cos^2(x) + cos(x) - 1 = 0$
- $(2cos(x) - 1)(cos(x) + 1) = 0$
- **$cos(x) = 1/2$ AND $cos(x) = -1$**

7. Composite Functions: $f(x) = 2x + 3$ and $g(x) = -x^2 + 5$; find $f(g(1))$

- $= f(-x^2 + 5)$ ... setting up to insert the original input
- $= f(-(1)^2 + 5)$
- $= f(-1 + 5)$
- $= f(4)$
- $= 2x + 3$ ... setting up to insert the new input
- $= 2(4) + 3$
- $= 8 + 3$
- **$= 11$**

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Assessment Set 2:

8. Rational Equations: $\frac{n-4}{n+4} = \frac{1}{n-5} + 1$
   - $((n+4)(n-5))\left(\frac{n-4}{n+4}\right) = \left(\frac{1}{n-5} + 1\right)((n+4)(n-5))$
   - $(n-5)(n-4) = n + 4 + (n+4)(n-5)$
   - $n^2 - 9n + 20 = n^2 - 16$
   - $-9n + 20 = -16$
   - $-9n = -16 - 20$
   - $-9n = -36$
   - $n = \frac{-36}{-9}$
   - $n = \frac{36}{9}$
   - $\underline{\boldsymbol{n = 4}}$

9. Radical Equations: $\sqrt{k-9} - \sqrt{k} = -1$
   - Option 1 (the better option)
     - $\left(\sqrt{k-9} - \sqrt{k}\right)\left(\sqrt{k-9} + \sqrt{k}\right) = (-1)\left(\sqrt{k-9} + \sqrt{k}\right)$
     - $k - 9 - k = -\sqrt{k-9} - \sqrt{k}$
     - $\sqrt{k-9} + \sqrt{k} = 9$
     - $\left\{\begin{matrix} \sqrt{k-9} - \sqrt{k} = -1 \\ \underline{\sqrt{k-9} + \sqrt{k} = 9} \end{matrix}\right\}$
     - $2\sqrt{k-9} = 8$
     - $\sqrt{k-9} = 4$
     - $k - 9 = 16$
     - $k = 25$
   - Option 2 (the not as good option)
     - $\left(\sqrt{k-9} - \sqrt{k}\right)^2 = (-1)^2$
     - $-2\sqrt{k}\sqrt{k-9} + \left(\sqrt{k}\right)^2 + \left(\sqrt{k-9}\right)^2 = 1$
     - $2k - 2\sqrt{k}\sqrt{k-9} - 9 = 1$; -2$k$ from both sides
     - $-2\sqrt{k}\sqrt{k-9} - 9 = 1 - 2k$; +9 to both sides
     - $-2\sqrt{k}\sqrt{k-9} = 10 - 2k$
     - $\frac{-2\sqrt{k}\sqrt{k-9}}{-1} = \frac{10-2k}{-1}$
     - $2\sqrt{k}\sqrt{k-9} = 2k - 10$
     - $\left(2\sqrt{k}\sqrt{k-9}\right)^2 = (2k-10)^2$
     - $4(k-9)k = 4k^2 - 40k + 100$
     - $4k^2 - 36k = 4k^2 - 40k + 100$; -($4k^2 - 40k + 100$) from both sides
     - $4k - 100 = 0$
     - $4k = 100$
     - $\underline{\boldsymbol{k = 25}}$

10. Simple Exponents: $3^{1-2x} = 243$
    - $3^{1-2x} = 3^5$
    - $1 - 2x = 5$
    - $-2x = 5 - 1$
    - $-2x = 4$
    - $\underline{\boldsymbol{x = -2}}$

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11. Not-So-Simple Exponents: $9^{n+10}+3=81$

- $9^{n+10}=81-3$
- $9^{n+10}=78$
- $n+10=\log_9 78$
- $n+10=\frac{\log 78}{\log 9}$; $\log 9 \rightarrow \log 3^2 \rightarrow 2\log 3$
- $n+10=\frac{\log 78}{2\log 3}$
- $n=\frac{\log 78}{2\log 3}-10$
- ***n* = -8.0172**

12. Quadratic Equations: $4b^2+8b+7=4$; Round answer to 2 decimal places.

- $4b^2+8b+7-4=0$
- $4b^2+8b+3=0$
- $b=\frac{-(8)\pm\sqrt{(8)^2-4(4)(3)}}{2(4)}$
- $b=\frac{-(8)\pm\sqrt{64-48}}{8}$
- $b=\frac{-(8)\pm\sqrt{16}}{8}$
- $b=\frac{-(8)\pm 4}{8}$
- $b=\frac{-(8)-4}{8}$ AND $b=\frac{-(8)+4}{8}$
- $b=\frac{-12}{8}$ AND $b=\frac{4}{8}$
- $\boldsymbol{b=\frac{-3}{2}}$ **AND** $\boldsymbol{b=\frac{1}{2}}$

13. Trigonometry: $4sin^2x+5=6$; $0\le x\le 360$

- $4sin^2x=1$
- $sin^2x=\frac{1}{4}$
- $\sin(x)=\frac{1}{2},-\frac{1}{2}$
- **x =30°,150°, 210°, 330°**

14. Composite Functions: $f(x)=|x-6|+x^2-1$ and $g(x)=2x$; find $f(g(3))$

- $g(3)=2(3)$
- $g(3)=6$
- $f(6)=|6-6|+6^2-1$
- $f(6)=36-1$
- $\boldsymbol{f(6)=35}$