Basic Skills Test Review

NOTE: Because of the basic skills test on Friday, this worksheet is different from those we'll use during the rest of the term. Future worksheets will be more directed, but for today your team will decide which topics you'd like to concentrate on.

The following questions are designed to help you think about what you need to study for the Basic Skills Test.

During the class period, you and your group should **DISCUSS** (yes, TALK in class!) the answers to these questions. Some answers may take 5 seconds and others will require lengthy discussions. Take notes if something is useful to you, but don't try to write out complete answers.

If a question below touches on a subject you are shaky on, your group might try the following three-step attack:

- Talk through the answer with your group.
- Look through the sample Basic Skills Test and find a question on that subject. Work through that example until the entire group understands it.
- Invent your own examples. See if you can come up with some really confusing ones (and share those with your instructor!).

---

1. POLYNOMIALS and RATIONAL FUNCTIONS
   (a) How do you add two polynomials? How do you divide them? What can you do to simplify your answers (if anything)?
   (b) When do you need to find a common denominator? Why? How?
   (c) What's the rule for multiplying two fractions? What's the rule for division?
   (d) What is the difference between the following expressions?
   $(x^2 + 5x)(3x^3 - 7)$ $\quad x^2 + 5x(3x^3 - 7)$ $\quad (x^2 + 5x)3x^3 - 7$
   (e) What's the formula/procedure for factoring the difference of two squares? Is there a formula for factoring the sum of two squares?
   (f) What's the formula/procedure for factoring the difference of two cubes? Is there a formula for factoring the sum of two cubes?
   (g) When and how does "cancellation" work? On which of the following will cancellation work? How?
   $\frac{x^2(x-3)(x+4)}{2(x+4)^2}$ $\quad \frac{x^2(x+4)+4}{2(x+4)^2}$ $\quad \frac{x^2(x-3)(x+4)}{2(x-4)^2}$
   $\frac{x^2(x+4)+(x-3)(x+4)}{2(x+4)^2}$ $\quad \frac{x^2(x-3)(x+4)}{2(x+4)^2+7}$ $\quad \frac{x^2-3x}{2x(x+4)}$

2. POWERS/EXPONENTS
   (a) What does a negative exponent mean?
   (b) What does a fractional exponent mean?
   (c) How do you multiply two exponential expressions (and combine them into one expression)? Do they need to have the same base? Why?
   (d) Can you add two exponentials (and combine them into one) if they have the same base?
   (e) How do you write the square root as an exponential?
   (f) Can you add two square roots, like $\sqrt{3} + \sqrt{5}$? If so, how?
   (g) Can you multiply two square roots, like $\sqrt{3}\sqrt{5}$? If so, how?
   (h) Is there a distributive law of exponents over addition? (for example: $(x + 3)^2 \stackrel{?}{=} x^2 + 3^2$??).
   (i) What is the difference between $2^{(3^4)}$ and $(2^3)^4$ and 2^{12} and $2^3 2^4$ and 2^7 and $(2 \times 3)^4$? Which of these are equal?

3. GEOMETRY
   (a) What are the basic formulas for: the area of a circle, the circumference of a circle, the area and perimeter of a rectangle, the surface area and volume of a cylinder, the surface area and volume of a sphere?
   (b) How is the lateral surface area of a cylinder related to the circumference of a circle and the area of a rectangle?

(c) How is the volume of a cylinder related to the area of a circle?
(d) What are units for an area? Why? (How can you tell from a formula?)
(e) What are units for a volume? Why? (How can you tell from a formula?)

4. EQUATIONS

(a) If you think you have solved an equation, how can you check your solution?
(b) The following are some legitimate steps you can use to solve an equation. Can you think of any others?
   - Add (or subtract) the same thing to (from) both sides of an equation.
   - Multiply or divide both side of an equation by the same number, *as long as that number is not zero*.
   - ??
   - ??
   - ??

(c) How can you solve a quadratic equation by factoring (for example: $x^2 - x = 2$)? Will this work for every equation of the form $ax^2 + bx + c = 0$?
(d) What is the quadratic formula? How can you use it to solve a quadratic equation? How can you use it to factor a quadratic equation? What form must the equation be in?
(e) How can you tell if you'll get imaginary or complex numbers for a solution to the quadratic equation?
(f) How do you write the square root of a negative number in terms of the imaginary number "i"?
(g) How can you deal with an equation involving rational expressions ("fractions" with polynomials)?
(h) Talk through how to solve the following equations, explaining the reasons for each step (rather than just listing the steps).

$$3x + 4 = 2 \qquad 3x + 4 = 2x \qquad 3x^2 + 4 = 2 \qquad 3(x + 5) + 4 = 2$$

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

5. GRAPHING LINES

(a) What does the equation for a line look like?
(b) What does the equation for a horizontal line look like?
(c) What does the equation for a vertical line look like?
(d) Given the equation for a line, how can you find two points on it?
(e) Given the equation for a line, how can you identify the slope?
(f) Given some points on the line, how can you find its slope?
(g) How can you tell if two lines are parallel? Perpendicular?

6. TRIGONOMETRY

(a) Suppose we draw a point on the unit circle. How do you compute the associated angle (in radians)? Is there only one measure for the angle associated with this point? What is the sine and cosine of this(these) angle(s)? i.e., what do the sine and cosine mean *graphically*?
(b) How are $\tan(x)$, $\cot(x)$, $\sec(x)$, and $\csc(x)$ related to $\sin(x)$ and $\cos(x)$?
(c) What is the Pythagorean theorem (relating the lengths of the sides of a right triangle)? Which trig. identity comes from the Pythagorean theorem?
(d) For which angles do you know the EXACT values of sine and cosine? You should know three in each quadrant, plus the four between quadrants. Have each person in your group pick a different quadrant, and then draw the unit circle and triangles labeled with the angles and the sines/cosines of the angles you should know in that quadrant. Compare!
(e) Sketch the graphs of $\sin(x)$ and $\cos(x)$. Where do they have peaks? Where do they cross the x-axis? What is their period?
(f) How can you use the unit circle to identify which angles θ have a given sine (for example, $\sin(\theta) = \frac{1}{2}$)? Why are there many, many (more than 10!) solutions to $\sin(\theta) = \frac{1}{2}$?
(g) How many radians corresponds to a straight angle? How many degrees are in this angle? How can you use these facts to convert from radians to degrees or vice-versa?

IF YOU HAVE MORE TIME:
Work through some of the problems on the sample basic skills test.

For Instructors:

Hand out the worksheet first and emphasize that TEAMS SHOULD SPEND THE CLASS PERIOD GOING THROUGH THE <u>WORKSHEET</u>. When you hand out the sample BS Test, tell them that they are not supposed to work on it during classtime; it is only for reference and they will have plenty of time to work through BS Test problems at their team meetings this week.