Name: _____

Please show all work and justify your statements. Make and label sketches, draw conclusions (using complete sentences and including units), and box the final answers as appropriate.

1. The population of China t years from the start of 1993 can be approximated by $P(t) = 1.15(1.014)^t$ billion people. According to this model, how fast is the population growing at the start of 1993 and at the start of 2003?

2. Let $f(x) = 1/x^3$.

   (a) Use the definition of derivative to find f' and show that it satisfies the power rule.

   (b) Find an equation for the tangent line to f at $x = -1/2$. Sketch.

3. On what intervals is the graph of $y = \ln(x^2 + 1)$ concave up?

4. Find dy/dx, if
$$\text{(a) } y^\pi + \pi^x = 2 \qquad \text{(b) } x\cos(y) = \sin(xy)$$

5. A rubber balloon at a birthday party is inflated at a rate of 2 cm^3/s. How fast is the surface area increasing when the radius is 10 cm?

   Formulas: $V = \frac{4}{3}\pi r^3$, $A = 4\pi r^2$

1	2	3	4	5	total (50)	%

Prelim. course grade: %