Exam 2

Name: _____

Each problem is worth 15 points. Numerical estimates are unacceptable; for full credit you must show all your work and use the indicated methods.

1. Suppose the position of a particle after $t$ seconds is given by $f(t) = t^4 - 4t^2 + 1$. Determine when the particle is speeding up and when it is slowing down.

2. Find the equation for the tangent line to

$$f(x) = \sin(x)\cos(x)e^x$$

when $x = \frac{\pi}{4}$.

3. Use the differentation rules for $\sin x$ and $\cos x$ to prove the differentiation rule for $\cot x$

4. Use the definition of the derivative to find

$$\frac{\mathrm{d}}{\mathrm{d}x}\frac{1}{\sqrt{4x+3}}$$

5. Suppose the maximum height (in m) of a model rocket is given as a function of its liftoff velocity (in m/s) by

$$H(v) = \frac{50\sqrt[5]{x^3}}{\sqrt{x}}$$

Find $T'(1024)$. Give units and interpret your answer.

6. The functions $f, f'$, and $f''$ are pictured below. Label each graph with the appropriate function. Justify your answer by identifying how sign, slope and concavity correspond between the graphs of the function and its derivatives.