Provide a clear and organized presentation. Show all of your work, completely simplify your answers, and give exact values only, unless otherwise indicated.

1. (15 pts) Use either a linear approximation or differentials to approximate $\sqrt[3]{25}$
2. (20 pts) My cat Pythagoras stands 6 inches tall. He walks $2 \mathrm{ft} / \mathrm{s}$ directly away from a floor lamp in my living room that stands 6 feet tall. How fast is the tip of his shadow moving when he is 10 feet from the floor lamp?
3. (20 pts) My other cat Theta sits motionless, observing two mice. His lines of site to each of these mice are separated by $30^{\circ}$. The first mouse is 3 feet from Theta, whereas the second mouse is 5 feet from Theta at the one point in time when they both spot Theta. They immediately run directly away from, the first at $4 \mathrm{ft} / \mathrm{s}$ whereas the second at $6 \mathrm{ft} / \mathrm{s}$. How fast is the distance between the two mice changing 2 seconds after they flee?
4. (15 pts) Determine the absolute extrema for $f$ over $[0,3]$ if $f(x)=x^{4}-6 x^{3}+12 x^{2}-8 x$
5. (15 pts) Determine the absolute extrema for $f$ over $[-\pi, \pi]$ if $f(x)=x+2 \sin x$
6. (10 pts) Consider the following graph of $y=f(x)$ :

i) Determine all values of $x$ for which $f$ attains a relative maximum.
ii) Determine all values of $x$ for which $f$ attains a relative minimum.
iii) Determine all values of $x$ for which $f$ attains an absolute maximum.
iv) Determine all values of $x$ for which $f$ attains an absolute minimum.
7. (10 pts) Find $y^{\prime}$ if $y=\tanh ^{3} \sqrt{x+e^{1-x^{2}}}$
