

1. **(8 points)** Approximate the following quantities using a well-chosen approximation method. Your answer should be expressed as in decimal form.

(a) **(4 points)** $\sqrt{63.97}$.

(b) **(4 points)** $e^{0.002}$.

2. **(8 points)** Determine the following facts about the function $g(x) = 4x^3 + 15x^2 - 18x + 30$.

- (a) **(4 points)** Where are its critical points? Identify each critical point as a local maximum, a local minimum, or neither.

- (b) **(2 points)** Does it have any global maxima or minima? If so, where are they? If not, why not?

- (c) **(2 points)** Does it have any points of inflection? If so, where are they? If not, why not?

3. **(8 points)** A thief is sneaking eastwards along a wall at two miles per hour. However, 3 miles east and 4 miles south of him, a guard with a high-powered telescope is watching.
- (a) **(4 points)** The guard needs to swivel the telescope to keep it trained on the thief. How quickly should she be turning it?

(b) **(4 points)** How quickly is the distance between the thief and guard changing?

4. **(2 point bonus)**

Find a function $f(x)$ and value a such that a is a local minimum of $f(x)$, but is not revealed as such by the Second Derivative Test.