Once the exam begins, tear this page away to use for scratch calculations.

NAME: _____

1. What is the result of evaluating these indefinite integrals? Don't forget your $+C$s!

(a) $\displaystyle \int x^7 + \sqrt[7]{x} + 7 + \frac{1}{x^7}\, \mathrm{d}x$

(b) $\displaystyle \int \sec^2(7t)\, \mathrm{d}t$

(c) $\displaystyle \int -7\cos(\theta)\, \mathrm{d}\theta$

2. If $g'(t) = 8.5094 t^{1.71}$ and if $g(1) = 2.0289$, what must a formula for $g(t)$ be?

3. Let α be the function that takes some $t > 0$ as input and returns the area of the region bounded by the x-axis, the y-axis, the line $x = t$, and the graph of $y = 2 + x^3 \cos^4(x)$. Write down a formula for $\alpha'(t)$, the derivative of α.

4. Demonstrate how to calculate the value of this definite integral manually. Bonus points if you can concisely express its *exact* value, not just a decimal approximation.

$$\int\limits_0^2 \left| x^2 - 2 \right| \, \mathrm{d}x$$

5. Demonstrate how to calculate the value of this definite integral manually. Bonus points if you can concisely express its *exact* value, not just a decimal approximation.

$$\int\limits_0^{\frac{\pi}{4}} \frac{\sqrt{3 + \sin(2x)}}{\sec(2x)} \, \mathrm{d}x$$

6. Consider the graphs of the functions f and g defined by the formulas

$$f(x) = 6 - x \quad \text{and} \quad g(x) = \frac{4}{x-1},$$

and let $\mathscr{A}$ denote the region in the (x, y)-plane bounded by these graphs.

(a) Write down a definite integral that represents the area of $\mathscr{A}$, then use technology to compute a decimal approximation for this area.

(b) Write down two definite integrals, one with respect to x and the other with respect to y that each represent the volume of the solid generated by revolving $\mathscr{A}$ about the x-axis.

7. You are on the rooftop of St Mary's Medical Center, which, at 45 m high, is the tallest building in Grand Junction. A 37 kg chimpanzee is strapped into a harness dangling at the end of 30 m long rope anchored to the edge of the rooftop. (For the following calculations ignore air resistance, and use $9.797 \, \text{m/s}^2$ for gravitational acceleration near the earth's surface here in Grand Junction.)

(a) The rope itself has a linear mass of 1.2035 kg/ m (that is kg-per-meter). You determinedly pull this chimpanzee safely up onto the rooftop. How much *work* did you do?

(b) After you've finished pulling the chimp up, the fire department finally arrives and inflates a 4.1187 m thick rescue airbag at the base of the building. Realizing it will be the quickest way to get down, cradling the chimp in your arms you fall gently off the building's edge and land safely on the airbag below. For how long were you in the air between falling and landing on the rescue bag? (Suppose you have a mass of 81 kg.)