1. (30 pts) Evaluate the following expressions.

   (a) $\displaystyle\int \frac{5x^3 - 3x^2 + 2x}{x\sqrt{x}}\,dx$

   (b) $\displaystyle\int \frac{1}{x^3}\sec\left(1/x^2\right)\tan\left(1/x^2\right)\,dx$

   (c) $\displaystyle\frac{d}{dx}\int_{x^2}^{\cos x} \frac{t}{t^3+4}\,dt$

2. (12 pts) Verona Rupes is a cliff on Uranus's moon Miranda, 20,000 meters tall. The gravitational pull on the moon is $a(t) = -\frac{2}{25}$ meter/sec^2. Suppose a rock is dropped off the top of the cliff.

   Justify your answers to the following questions using calculus techniques. Write your answer in simplest radical form.

   (a) How long would it take for the rock to hit the ground?

   (b) How fast would the rock be going when it hit?

3. (20 pts) The following problems are not related.

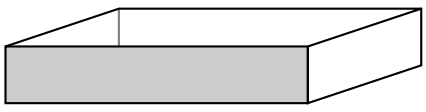
   (a) Find the slant asymptote of $y = \dfrac{6x^2 - x + 1}{2x + 3}$.

   (b) Find the sum $\displaystyle\sum_{i=1}^{100}(2i + 23)$ by applying sigma notation rules. Fully simplify your answer.

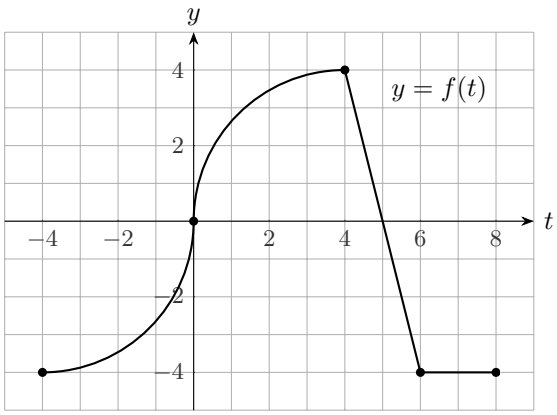
   (c) Suppose Newton's Method is applied to the continuous function $h(x)$. The equations for the tangent lines to $h(x)$ at five points on the curve are given below. Starting with an initial approximation of $x_1 = 0$, find the next two approximations x_2 and x_3. No justification is necessary for this problem.

Point	Tangent Line
$(-2, 0)$	$y = 10x + 20$
$(-1, 5)$	$y = x + 6$
$(0, 4)$	$y = -2x + 4$
$(1, 3)$	$y = x + 2$
$(2, 8)$	$y = 10x - 12$

4. (12 pts) An open-top rectangular box will have a height of 1 foot and a base area of 72 square feet. The front side of the box will cost 3 times as much per square foot as the base and the other three sides. What base dimensions will minimize the cost of materials?



5. (26 pts) Consider the continuous function $f(t)$ defined on $[-4, 8]$, shown below, consisting of two quarter-circles and two line segments.



(a) Find R_3, the right-endpoint approximation of $\displaystyle\int_{-4}^{8} f(t)\,dt$ on $n = 3$ subintervals.

(b) Find the average value of $f(t)$ on $[-4, 8]$.

(c) Let $g(x) = \displaystyle\int_{-4}^{x} f(t)\,dt$, $-4 \le x \le 8$. No justification is necessary for the following questions. Write NONE if appropriate.

i. At what value(s) of x does $g(x) = 0$?

ii. On what interval(s) is g decreasing?

iii. On what interval(s) is g concave down?