Calculus I, Sections 4, 5, 6.
Practice for Quiz 4

Show your work for all answers. You will get little or no credit for a correct answer if we cannot see how you got it. *In all integrals, check the result by differentiation. The answer is incomplete without this.*

1. Find an antiderivative of $f(t) = t \sin(t^2)$.

2. If $f'(x) = \dfrac{x+1}{\sqrt{x}}$ and $f(1) = -1$, find a formula for $f(x)$.

3. Calculate $\displaystyle\int_0^\pi \sin(x)\sqrt{2 + \cos(x)}dx$.

4. Estimate $\displaystyle\int_0^{\pi/2} \sin(h\cos(t))dt$ when h is small. Hint: use a first derivative approximation for $\sin(h\cos)$, which will be valid when h is small because $|\cos| \le 1$. We cannot, however, approximate $\cos(t)$ by something simpler because t is not small.

5. The parabola which is the graph of the function $y = x^2 - 2$ is rotated by 45° about the origin. Find the area of the rotated parabola below the x axis. Hint: we may instead choose to rotate the x axis.

6. People start arriving for a concert two hours early. The rate at which they arrive (in people per minute) is $r(t) = at$, where a is an unknown parameter and t is measured from the time the first person arrived (two hours early). One hour before the concert, 800 people have arrived. How many people will be at the concert when it starts?

7. An art deco cocktail glass has the shape of the graph of $y = a\sqrt{x}$ rotated about the y axis. If the liquid holding area (not the stem) is 5 cm. tall and has a diameter of 15 cm. at the rim, how much liquid can the glass hold when it is filled to the top (in cubic cm.)?

Extra credit. Draw, or have someone you know draw, a picture of the cocktail glass from question 5 half full.

More extra credit. Put the glass in the hand of an elegantly dressed 1920's party goer.