Name: _____ _____ **/ 20**

20 points possible. No aids (book, calculator, etc.) are permitted. You need not simplify unless asked, but show all work and use proper notation for full credit.

1. [5 points] Determine a function that satisfies the following constraints:

$$f''(x) = 12x^2 + \frac{6}{\sqrt{x}}, \quad f'(0) = 2, \quad f(1) = 4.$$

Clearly show your work.

2. [6 points] Compute the following integrals. Show your work.

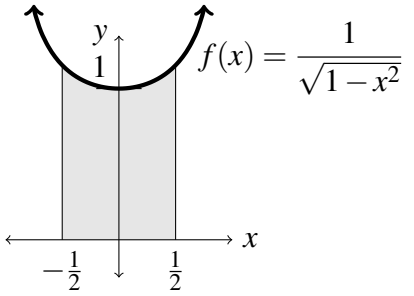
a. $\displaystyle\int_0^{\pi/6} \frac{\sin(x)}{8} + x \, dx$

b. $\displaystyle\int \frac{3 - te^t}{t} \, dt$

3. [1 points] If $g(x) = \int_3^x \ln(t^2)\, dt$, find $g'(2)$.

4. [2 points] Find the derivative of the function $F(x) = \int_4^{\ln(x)} \tan(t)\sqrt{3t^5 - 2}\, dt$.

5. [4 points] Find the **exact** value of the area shaded below. The thick curve is $f(x) = \frac{1}{\sqrt{1-x^2}}$. Show your work and simplify your answer.



6. [2 points] Suppose $r(t)$ is the rate of change of the number of positive cases of COVID-19 in Alaska, measured in cases per month (computed on the last day of the month, say), where $t = 0$ is March 2020.

a. What does $\int_6^8 r(t)\, dt$ measure? Use complete sentences.

b. Is it possible for $\int_a^b r(t)\, dt$, where $a < b$ and $a, b \geq 0$, to be a negative number? Why or why not?