Question 1:

(a)[3 points] Evaluate $\int \dfrac{\tan^{-1} x}{1 + x^2} \, dx$.

(b)[3 points] Suppose $\int_0^5 f'(x) \, dx = 11$, where $f'(x)$ is continuous. If $f(0) = -2$, what is $f(5)$?

(c)[4 points] Suppose the average value of $f(x) = 6x(x - 1)$ over the interval $x = 0$ to $x = k$ is k. What is k?

Question 2 [10 points]: Evaluate $\dfrac{9}{4} \displaystyle\int_1^4 \sqrt{t}\, \ln t \, dt$.

Question 3 [10 points]: Evaluate

$$\int \frac{x^2}{16\sqrt{16 - x^2}}\, dx$$

Question 4 [10 points]: Evaluate

$$\int \frac{3x^2 + 8}{x^3 + 4x}\, dx$$

Question 5 [10 points]: Evaluate

$$\int_0^{\pi/3} \sin^7(3t) \cos^3(3t)\, dt$$