

You must show all of your work to receive full credit!

| No. | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|-------|---|---|---|---|---|---|-------|
| score | | | | | | | |

- (1) (28 points, 7 points for each part) Evaluate the following integrals: (Decimal approximations such as 2.1234 will not get any credit.)

(a) $\int_0^1 (3x^2 + e^x - 1) dx =$

(b) $\int \left(\frac{1}{1+x^2} + \sin(4x-3) \right) dx =$

(c) $\int_1^e \frac{1}{x} \sqrt{\ln x} dx =$

(d) $\int \frac{1}{\sqrt{x}} \sec(\sqrt{x}) \tan(\sqrt{x}) dx =$

(2) (18 points, 6 points for each part) Find:

(a) $F'(x)$ if $F(x) = \int_7^{x^3} t \cos(e^t) dt$.

(b) $f(x)$ if $f'(x) = 3 + \sec^2 x - \frac{1}{\sqrt{1-x^2}}$ **and** $f(0) = 1$.

(c) $\int_1^2 f'(x) dx$ **if** $f(1) = 3$, $f(2) = 7$, and f' is continuous on $[1, 2]$.

(3) (14 points, 7 points for each part) Evaluate the following limits (If you use L'Hôpital's rule make sure to justify its use):

(a) $\lim_{x \rightarrow 0} \frac{x^4}{1 - \cos(x^2)}$

(b) $\lim_{x \rightarrow +\infty} \frac{3x + 1}{1 + \ln x}$

- (4) (12 points, 4 points for each part) Given the following information about two functions f and g :

$\int_0^7 f(x)dx = -1$, $\int_0^4 f(x)dx = 3$, $\int_0^7 g(x)dx = -3$. Find the exact value of each of the following (Make sure to show your work):

(a) $\int_0^7 (f(x) - 5g(x))dx$

(b) $\int_4^7 f(x)dx$

(c) The average value of g on the interval $[0, 7]$.

- (5) (12 points) Find, **but don't evaluate**, a definite integral whose value gives the area of the bounded region enclosed by the graphs of $y = x^2$ and $y = 6 - x^2$. Make sure to sketch the region.

- (6) (16 points) A storage shed of the volume $60m^3$ is to be constructed with a flat roof and a square base. The cost **per square meter** of the material is \$10 for the floor and the sides, and \$15 for the roof. Find the dimensions of the shed that has the least construction cost.