Name: _____

1. Use the comparison test to determine whether the integral $\int_1^\infty \frac{\tan^{-1} x}{x}\, dx$ converges or diverges.

5 pts

2. Suppose that f and g are continuous functions with $f(x) \geq g(x) \geq 0$ for $x \geq a$. If $\int_a^\infty f(x)\, dx$ diverges then (circle one):

5 pts

   (a) $\int_a^\infty g(x)\, dx$ must diverge.

   (b) $\int_a^\infty g(x)\, dx$ must converge.

   (c) Convergence/divergence of $\int_a^\infty g(x)\, dx$ cannot be determined with the information given.

3. Use calculus to find an equation of the tangent to the curve $x = e^t$, $y = (t-1)^2$ at the point $(1, 1)$ **without eliminating the parameter**.

10 pts

(OVER)

4. Consider the curve given by $y = \dfrac{x^4}{16} + \dfrac{1}{2x^2}$ for $2 < x < 3$.

   (a) Set up an integral for the length of the curve. **You need not evaluate the integral**.

10 pts

   (b) Rotating the curve about the x-axis produces a surface. Set up an integral for the surface area. **You need not evaluate the integral**.

10 pts

   (c) Rotating the curve about the y-axis produces a surface. Set up an integral for the surface area. **You need not evaluate the integral**.

10 pts

5. Find the centroid of the region bounded by the curves $y = \sin(x)$, $y = 0$, $x = \pi/4$, and $x = 3\pi/4$. **You may leave your answer in terms of integrals. You need not evaluate the integrals.** Put a box around your answer.

20 pts

6. Consider the curve given by $x = t - e^t$, $y = t + e^{-t}$. Find d^2y/dx^2. Put a box around your answer.

10 pts

(OVER)

7. Consider the graphs below, and complete all three bullet items:

20 pts

- Match the parametric equations $x = f(t)$ and $y = g(t)$ in (a)–(d) with the parametric curves numbered I–IV. Place the numbers in the spaces provided.

  (a) _____
  (b) _____
  (c) _____
  (d) _____

- ON EACH PARAMETRIC GRAPH I–IV, DRAW A LARGE DOT AT THE POINT IN THE X-Y PLANE CORRESPONDING TO $t = 0$, using the corresponding parametric equations $x = f(t)$ and $y = g(t)$ in (a)–(d) as a guide.
- ON GRAPHS I–IV DRAW AN ARROW TO INDICATE THE DIRECTION OF INCREASING T, using the corresponding parametric equations $x = f(t)$ and $y = g(t)$ in (a)–(d) as a guide.