

Practice Problems for Test 2

Set 2

1. Consider the integral $\int \text{Arctan } x \, dx$.
 - (a) Use the integration by parts formula on this integral. Clearly indicate your choice for u and v , as well as their differentials, du and dv
 - (b) Using part (a), complete the integration.
 - (c) Check your answer (how?)
2. Is the following improper integral convergent or divergent?
$$\int_2^{\infty} \frac{dx}{x(\ln x)^2}$$

If it is convergent, find the value of the integral.

3. Consider curve given by $x = t^2$, $y = t^3 - 3t$
 - (a) Find the equations of all horizontal tangent lines to the curve.
 - (b) Find an expression for the second derivative, $\frac{d^2y}{dx^2}$.
4. Consider the curve given parametrically by $x = e^t$, $y = \ln t$.
 - (a) Write an expression for the differential of arc length, ds .
 - (b) Set up an integral that gives the length of the curve from $t = 1$ to $t = 2$.

(c) Set up an integral that gives the length of the curve from $t = 1$ to $t = 2$. (c) Use the calculator to evaluate this integral to at least 4 decimal places.

5. Find the area bounded by the curve given in polar coordinates $r = 1 + 3\theta$, inside the sector $0 < \theta < 7\pi$.

6. Are the following sequences $\{a_n\}$ convergent or divergent? If convergent, find the limit of the sequence.

(a) $a_n = e^n (n^2 + 3)$

(b) $a_n = \sqrt{n+1} - \sqrt{n}$

7. Determine if the following series are convergent or divergent. If convergent, find the sum of the series.

(a)
$$\sum_{n=1}^{\infty} \frac{3n}{2n-1}$$

(b)
$$\sum \frac{(-1)^n}{\pi^n}$$