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Worksheet 6, Math 10560

Times indicate the amount of time that you would be expected to spend on the problem in on an exam. All problems have appeared on old exams for Calculus 2.

1. (4 mins) Evaluate the integral or show that it is divergent

$$\int_{-\infty}^{3} \frac{1}{x^2 - 4x + 5}\, dx$$

2. (4 mins) Find the arc length of the curve $y = \dfrac{e^{2x} + e^{-2x}}{4}$, $0 \leq x \leq 2$, using the arc length formula.

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3. (8 mins) Complete the following sentences using the words *converges* and *diverges* :

$\int_1^\infty \frac{1}{x^p}$ _____ if $p > 1$ and _____ if $p \leq 1$.

$\int_0^1 \frac{1}{x^p}$ _____ if $p > 1$ and _____ if $p \leq 1$.

Decide whether the following improper integrals converge or diverge by comparing them to a known integral. In each case, state which integral you are comparing the given integral to and state clearly why you can conclude convergence or divergence.

(a) $\int_1^\infty \frac{1}{x^2 + x + 5}\, dx$

(b) $\int_1^\infty \frac{1}{xe^x}\, dx$

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4. Let $y' = (x-2)(y-x)$ with $y(1) = 2$.

   (a) Draw a 3×3 direction field ($x = 1, 2, 3$, $y = 1, 2, 3$), and approximate solution curve.

   (b) Use Euler's method with $\Delta x = 1$ to estimate $y(3)$. How close is Euler's method to the solution curve you drew by hand above?

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5. Find the arc length of the circle $y^2 + x^2 = 16$ between the point $(3, \sqrt{7})$ and $(3, -\sqrt{7})$ (using the shorter arc between them) using the arc length formula.