

MA 114 Worksheet # 24: Review for Exam 3

1. Compute

(a) $\int \frac{dx}{x^2 - 6x + 8}$

(c) $\int \frac{x^2}{x^2 + 9} dx$

(b) $\int \frac{3}{(x+1)(x^2+x)} dx$

(d) $\int \frac{x^2 + 2}{x + 3} dx$

2. Compute $\int \frac{e^x}{e^{2x} - e^x} dx$.

Hint: First do a substitution, and then use partial fractions.

3. Evaluate $\int \frac{dx}{x^2 - 1}$ first with a trig substitution and then with partial fractions. Verify that the answer is the same in both cases.

4. Use trigonometric substitution to evaluate the integral $\int \frac{dx}{x^2 \sqrt{x^2 - 8}}$.

5. Find the arc length of $f(x) = \ln(\sec(x))$ from $x = 0$ to $x = \pi/4$.

6. Find the surface area of the solid of revolution obtained by revolving $\sqrt{9 - x^2}$ about the x -axis for $-2 \leq x \leq 2$.

7. Consider point masses m_1 , m_2 , and m_3 centered at $(-1, 0)$, $(3, 0)$, and $(0, 4)$ respectively. If $m_1 = 6$, find m_2 so that the center of mass lies on the y -axis.

8. Find the centroid of the top half of the ellipse $(\frac{x}{2})^2 + (\frac{y}{4})^2 = 1$.

9. Use separation of variables to solve $y' + 4xy^2 = 0$.

10. Use separation of variables to solve $y' = (x + 1)(y^2 + 1)$.

11. Solve the initial value problem $y' + y^2 \sin x = 0$, $y(\pi) = 2$

12. Find the solutions to $y' = -2y + 8$ subject to $y(0) = 3$ and $y(0) = 4$, respectively, and sketch their graphs.

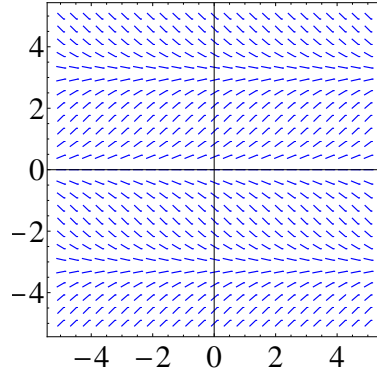
13. Match each of the slope fields below with exactly one of the differential equations. (The scales on the x - and y -axes are the same.) Also, provide enough explanation to show why no other matches are possible.

(i) $y' = xy + 1$

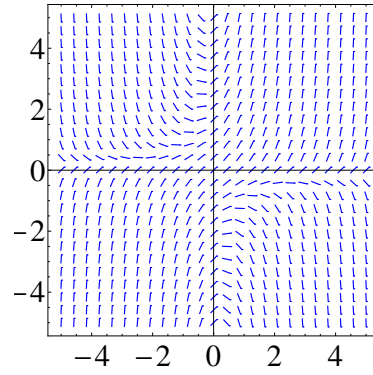
(ii) $y' = xe^{-y}$

(iii) $y' = y^2 + 1$

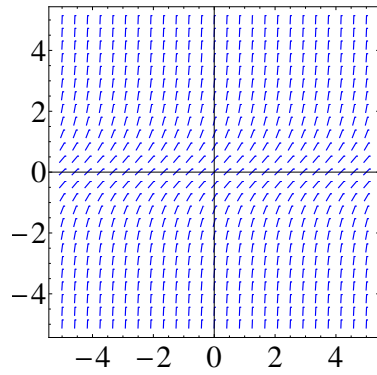
(iv) $y' = \sin y$



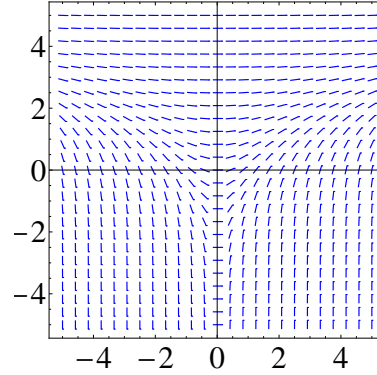
(a)



(b)



(c)



(d)

Figure 1: Slope fields for Problem 13