**Pre-calculus: Problem Set 14**

Review of topics in Algebra 1 and College Algebra and extensions

1. Write an equation for a circle centered at the origin with an x-intercept of (4, 0).

2. Find the center and radius of the circle given by the equation $x^2 + y^2 + 4x + 10y + 15 = 0$.

Simplify the following.

3. \( \frac{7^{3y-x}}{7^{4x-6y}} \)

4. \( 5^{2x-3}5^{6-4x} \)

5. \( (3^{2x-6})^2 \)

6. \( e^x(e^{-x}+1)-e^{-x}(e^x+1) \)

Find the difference quotient, \( \frac{f(x+h) - f(x)}{h} \), for the following.

7. \( f(x) = 2x^2 - 5 \)

8. \( f(x) = \sqrt{3-x} \)

9. \( f(x) = \frac{2}{x+5} \)

10. \( f(x) = \frac{1}{\sqrt{x-4}} \)

Use \( f(x) = -\frac{1}{2}x^2 - x + 2 \) to answer 11 – 15.

11. Write \( f(x) \) in standard form (\( f(x) = a(x-h)^2 + k \)).

12. Find the vertex of \( f(x) \).

13. Find the range of \( f(x) \).

14. Find the x- and y-intercepts of \( f(x) \).

15. Identify the intervals for which \( f(x) \) is increasing and decreasing.

**Solutions to Odd Problems:**

1. C: (0, 0)  x-int: (4, 0)  
   The radius is 4.

\[
\begin{align*}
x^2 + y^2 &= 16 \\
\frac{7^{3y-x}}{7^{4x-6y}} &= \left(3^{2x-6}\right)^2 \\
7^{(3y-x)-(4x-6y)} &= 3^{2(2x-6)} \\
7^{9y-5x} &= 3^{4x-12}
\end{align*}
\]

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7. \[
\frac{f(x+h) - f(x)}{h} = \frac{2(x+h)^2 - 5 - (2x^2 - 5)}{h} = \frac{2x^2 + 4xh + 2h^2 - 2x^2 + 5}{h} = \frac{4xh + 2h^2}{h} = 4x + 2h
\]

9. \[
\frac{f(x+h) - f(x)}{h} = \frac{2(x+5) - 2(x + h + 5)}{h(x+5)(x + h + 5)} = \frac{2x + 10 - 2x - 2h - 10}{h(x+5)(x + h + 5)} = \frac{-2h}{h(x+5)(x + h + 5)} = \frac{-2}{(x + 5)(x + h + 5)}
\]

11. \[
f(x) = \frac{-1}{2} x^2 - x + 2
\]

13. \[
R: \left[ -\infty, \frac{5}{2} \right]
\]

15. \[
f(x) \text{ is increasing on } (-\infty, -1)
\]

Answers to Even Problems:

2. C: (-2, -5) \[ r = \sqrt{14} \]

4. \[ 5^{3-2x} \]

6. \[ e^x - e^{-x} \]

8. \[ \frac{-1}{\sqrt{3-x-h} + \sqrt{3-x}} \]

10. \[ \frac{-1}{\sqrt{x-4} - \sqrt{x + h - 4}} \]

12. \[ \left( -1, \frac{5}{2} \right) \]

14. \[ (0,2), (-1 \pm \sqrt{5},0) \]