Question 1:

Determine all significant information, such as vertices, center, axis of symmetry, directrix, foci, and asymptotes and sketch the graph of the following conic sections:

Find first of all the standard form of each equation then determine the value of a, b, c *or* p (for the parabola.

1. $9x^2 - 72x - 16y^2 - 32y = 16$

2. $y^2 - 6y + 9 - x = 0$

3. $4y^2 - 8y + 6x^2 + 12x = 36$

4. $6x^2 + 12x + 6y^2 - 8y = 100$

Question 2:

Find the following limits

1. $\lim_{x\to 0} \dfrac{x^2 - 3x + 1}{x + 1}$

2. $\lim_{x\to 5} \dfrac{x^2 - 25}{x - 5}$

3. $\lim_{x\to \frac{5}{4}^+} \dfrac{|5 - 4x|}{4x - 5}$

4. $\lim_{x\to 0} \dfrac{\sqrt{4 - x} - 2}{x}$

5. $\lim_{x\to -\infty} -x^3 - 3x + 4$

6. $\lim_{x\to +\infty} \dfrac{x^4 + 3x - 2}{-x^2 + 3x - 1}$

Question 3:

Use the limit to find the derivative of

a. $f(x) = \sqrt{1-4x}$

b. $f(x) = -\frac{2}{x^2}, \quad \text{find } f'(1)$

Question 4:

Find the derivatives of the following functions (***do not simplify***)

1. $f(x) = (x^{-3} + 4x^2)(6x + 4)$

2. $y = (r^2 + 7r)^2 - \frac{1}{\sqrt{r}}$

3. $f(t) = (5\sqrt{t} + \frac{3}{t^2})^3$

4. $f(x) = \frac{x^2 + 1}{\sqrt[5]{x^3 - 3}}$

Question 5 :

1. Use the definition of the derivative to find the derivative of $f(x) = x^2 - 2x$

2. Find the equation of the tangent line to the graph of $f(x) = -3x + \frac{1}{x}$ at $x = 1$

3. At what point(s) does the function $f(x) = (x^2 - 1)^3$ have a horizontal line?

Question 6 :

1. Find y' for the equation $\frac{x}{y} - y^2 + 1 = 0$

2. Find the equation of the tangent line to the graph defined by the equation:

$$y^2 = xy + 2 \quad \text{at } (x, y) = (1,2)$$

Question 7: Related Rate problems

1. A weather balloon leaves the ground 275 metres from an observer and rises vertically at a rate of 12 metres per sec. How fast is the length of the line of sight from the observer to the balloon increasing when the balloon is 450 metres above the ground.

2. A plane is flying directly away from you at 500 mph at an altitude of 3 miles. How fast is the plane's distance from you increasing at the moment when the plane is flying over a point on the ground 4 miles from you?

3. Air is being blown into a spherical balloon at a constant rate of 1000 cubic cm per sec. What is the rate of change of the radius when the radius is 10 cm?