ITMTA-B22 TGV Group 4 Practice Problems

1. **Find the derivative of the given functions:**

- $f(x) = 6x^3 - 9x + 4$
- $y = 2t^4 - 10t^2 + 13t$
- $g(z) = 4z^7 - 3z - 7 + 9z$
- $h(y) = y^{-4} - 9y^{-3} + 8y^{-2} + 12$
- $y = \sqrt{x} + 8\sqrt[3]{x} - 2\sqrt[4]{x}$
- $f(x) = \frac{10x^3}{5\sqrt{x^3}} - \frac{\sqrt{x^7}}{6\sqrt[3]{x^8}} - 3$
- $f(t) = 4t - \frac{1}{6t^3} + \frac{8}{t^5}$
- $R(z) = 6\sqrt{z^3} + \frac{1}{8z^4} - \frac{1}{3z^{10}}$

2. **Solve for z:**

$$z = x(3x^2 - 9)$$

3. **Expand and simplify:**

$$g(y) = (y - 4)(2y + y^2)$$

4. **Factor:**

$$h(x) = 4x^3 - 7x + 8x$$

5. **Find where the function is not changing:**

- $f(x) = x^3 + 9x^2 - 48x + 2$
- $y = 2z^4 - z^3 - 3z^2$

6. **Tangent lines:**

- Find the tangent line to $g(x) = 16x - 4\sqrt{x}$ at $x = 4$.
- Find the tangent line to $f(x) = 7x^4 + 8x - 6 + 2x$ at $x = -1$.

7. **Velocity and direction:**

- The position of an object at any time t is given by $s(t) = 3t^4 - 40t^3 + 126t^2 - 9$. Determine the velocity of the object at any time t. Does the object ever stop changing? When is the object moving to the right, and when is it moving to the left?

8. **Increasing and decreasing functions:**

- Determine where the function $h(z) = 6 + 40z^3 - 5z^4 - 4z^5$ is increasing and decreasing.

- Determine where the function $R(x) = (x+1)(x-2)^2$ is increasing and decreasing.

9. **Parallel tangent lines:**

- Determine where, if anywhere, the tangent line to $f(x) = x^3 - 5x^2 + x$ is parallel to the line $y = 4x + 23$.