Integration/Differentiation Problem Set 1

Problem 1. Differentiate the following

1. $f(x) = 2x^3 + \dfrac{300}{x^3} + 4$
2. $f(x) = 4x - 8\sqrt{x}$
3. $f(x) = 2x^3 - 21x^2 + 60x - 10$
4. $f(x) = \sqrt[3]{x^2}(2x - x^2)$
5. $f(x) = \dfrac{2x^5 + x^2 - 5}{x^2}$

Problem 2. Assume the function $C(t) = -(t-1)^2 + t + 1$ describes my trip (in miles) from Columbia SC to Charleston SC and t is the number of hours after I started my trip. How fast (mph) was I going 2 hours after I started my trip?

Problem 3. Determine where, if anywhere, the following functions are **NOT** changing.

1. $f(z) = 2z^4 - z^3 - 3z^2$
2. $g(x) = x^3 + 9x^2 - 48x + 2$

Problem 4. Determine **where** the following functions are increasing and decreasing.

1. $h(z) = 6 + 40z^3 - 5z^4 - 4z^5$
2. $R(x) = (x+1)(x-2)^2$
3. $f(x) = 4x^3 - 18x^2 - 336x + 27$
4. $V(t) = t^3 - 24t^2 + 192t - 50$

Problem 5. Evaluate the following integrals.

1. $\displaystyle\int 4x\cos(2-3x)\,dx$
2. $\displaystyle\int_6^0 (2+5x)e^{\frac{1}{3}x}\,dx$
3. $\displaystyle\int (3t+t^2)\sin(2t)\,dt$
4. $\displaystyle\int 6\tan\left(\frac{8}{w}\right)\,dw$
5. $\displaystyle\int e^{2z}\cos\left(\frac{1}{4}z\right)\,dz$
6. $\displaystyle\int_0^{\pi} x^2\cos(4x)\,dx$

Problem 6. Evaluate the following integrals.

1. $\displaystyle\int (8x-12)(4x^2-12x)^4\,dx$

2. $\displaystyle\int 3t^{-4}(2+4t^{-3})^{-7}\,dt$

3. $\displaystyle\int \frac{4w+3}{4w^2+6w-1}$

4. $\displaystyle\int \Big(\cos(3t)-t^2\Big)\Big(\sin(3t)-t^3\Big)^5\,dt$

5. $\displaystyle\int \frac{\sqrt{x^2+16}}{x^4}\,dx$

6. $\displaystyle\int_{-7}^{-5} \frac{2}{y^4\sqrt{y^2-25}}\,dy$

7. $\displaystyle\int_1^4 2z^5\sqrt{2+9z^2}\,dz$

8. $\displaystyle\int_1^4 2z^5\sqrt{2+9z^2}\,dz$

9. $\displaystyle\int \frac{(z+3)^5}{(40-6z-z^2)^{\frac{3}{2}}}\,dz$

10. $\displaystyle\int \cos(x)\sqrt{9+25\sin^2(x)}\,dx$