3. (20pts) Start this problem on a **new** page. The following problems are not related.

(a)(10pts) For what value(s) of $x \in \mathbb{R}$ does the function $f(x) = 2x^3 + 3x^2 - 12x + 1$ have a *horizontal tangent*?

(b)(10pts) The position function of a particle is given by $s(t) = t^3 - 4.5t^2 - 7t$ where $t \geq 0$ is in seconds and distance is in feet. (*i*)(5pts) Find the velocity of the particle as a function of t. (*ii*)(5pts) When is the acceleration equal to 0?

Solution:

(a)(10pts) We need to find all x in the domain such that $f'(x) = 0$, note that

$$f'(x) = [2x^3 + 3x^2 - 12x + 1]' = 6x^2 + 6x - 12 = 6(x^2 + x - 2) = 6(x + 2)(x - 1)$$

thus $f'(x) = 0 \quad x = -2, 1$ which is in the domain since $f(x)$ is a polynomial thus $f(x)$ has horizontal tangents at $x = -2, 1$.

(b)(*i*)(5pts) Here we have the velocity is $v(t) = s'(t) = [t^3 - 4.5t^2 - 7t]' = 3t^2 - 9t - 7$.

(b)(*ii*)(5pts) The acceleration is $a(t) = v'(t) = [3t^2 - 9t - 7]' = 6t - 9$ thus $a(t) = 0 \quad 6t - 9 = 0 \quad t = \frac{9}{6}$ sec.

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4. (28pts) Start this problem on a **new** page. The following problems are not related.

(a)(12pts) If $y = \sec(x)$, find y'