20) a) $f(x) = 5x^2 + 4x$

$f'(x) = 10x + 4$

$f' = 0$ | $10x + 4 = 0$

$\boxed{x = \frac{-4}{10} = \frac{-2}{5}}$

$f'$ DNE | No

b) $f(x) = -2x^3 + 6x + 5$

$f'(x) = -6x^2 + 6$

$f' = 0$ | $-6x^2 + 6 = 0$

$x^2 = 1$

$\boxed{x = \pm 1}$

$f'$ DNE | No

c) $f(x) = 5x^4 - 8x^3 - 6x^2 + 87$

$f'(x) = 20x^3 - 24x^2 - 12x$

$f' = 0$ | $4x(5x^2 - 6x - 3) = 0$

$x = 0$ or $x = \frac{6 \pm \sqrt{36 + 60}}{10}$

$\boxed{x = 0 \text{ or } x = \frac{3 \pm 2\sqrt{6}}{5}}$

$f'$ DNE | No

d) $y = \frac{\sin x}{2 + \cos x}$

$y' = \frac{(2 + \cos x)\cos x - \sin x(-\sin x)}{(2 + \cos x)^2}$

$= \frac{2\cos x + \cos^2 x + \sin^2 x}{(2 + \cos x)^2}$

$= \frac{2\cos x + 1}{(2 + \cos x)^2} = y'$

$f' = 0$ | $2\cos x + 1 = 0$

$\Rightarrow \cos x = -\frac{1}{2}$

$\boxed{x = \frac{2\pi}{3} + 2n\pi, \quad n \in \mathbb{Z}}$
$\boxed{x = \frac{4\pi}{3} + 2n\pi}$

$f'$ DNE | $(2 + \cos x)^2 = 0$

$\Rightarrow \cos x = -2$

can't happen

21a) $f(x) = x^3 + x^2 + 9$ on $[-4, 4]$

$f'(x) = 3x^2 + 2x$

$f' = 0$ | $x(3x + 2) = 0$ $\quad$ $f'$ DNE | No

$x = 0, x = -\frac{2}{3}$

$f(0) = 9$

$f(-\frac{2}{3}) = \frac{-8}{27} + \frac{4}{9} + 9 \approx 9.5$

$f(-4) = -64 + 16 + 9 = -39$ Abs min

$f(4) = 64 + 16 + 9 = 89$ Abs max

] values

b) $f(x) = 3x^2 - 12x + 5$ on $[0, 3]$

$f'(x) = 6x - 12$

$f' = 0$ | $6(x - 2) = 0$ $\quad$ $f'$ DNE | No

$x = 2$

$f(2) = 12 - 24 + 5 = -7$ Abs min

$f(0) = 5$ Abs max

] values

$f(3) = 27 - 36 + 5 = -4$

---

22] If $f$ is diff @ $a$, then $f$ is cont @ $a$.

True

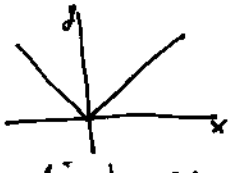
23] If $f$ is cont. @ $a$, then $f$ is diff @ $a$.

False. Consider

$f(x) = |x|$.

Note $f$ is continuous @ $x = 0$,

but $f'(0)$ DNE.




24] The MVT applies to $\cos x - x^{-1}$ on $[5, 6]$.

True

25] $f'(x) = 0 \Rightarrow f$ has a local max or min @ $x$.

False: $f(x) = x^3$ @ $x = 0$ has $f'(0) = 0$ but no max/min @ 0.

26] $f''(x) = 0 \Rightarrow f$ has a pt of infl. @ $x$.

False: $f(x) = x^4$. @ $x = 0$, $f''(0) = 0$ but no infl pt.