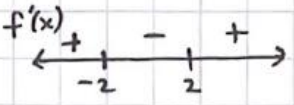
AP Calculus BC — Inc/Dec, First Derivative Test

1) a) $f(x) = x^3 - 12x$

$f'(x) = 3x^2 - 12 = 0$

$x = \pm 2$



Inc: $(-\infty, -2) \cup (2, \infty) \rightarrow f'(x) > 0$

Dec: $(-2, 2) \rightarrow f'(x) < 0$

Max @ $x = -2 \rightarrow f'(x)$ Δs signs from + to −

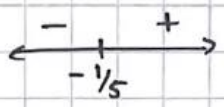
Min @ $x = 2 \rightarrow f'(x)$ Δs signs from − to +

b) $g(x) = xe^{5x}$

$g'(x) = 5xe^{5x} + e^{5x} = 0$

$= e^{5x}(5x + 1) = 0$

$x = -1/5$



Inc: $(-1/5, \infty) \rightarrow f'(x) > 0$

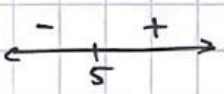
Dec: $(-\infty, 1/5) \rightarrow f'(x) < 0$

Min @ $x = -1/5 \rightarrow f'(x)$ Δs signs from − to +.

c) $f(x) = (x-5)^{2/3}$

$f'(x) = \frac{2}{3}(x-5)^{-1/3}$

$= \frac{2}{3(x-5)^{1/3}}$



Inc: $(5, \infty) \rightarrow f'(x) > 0$

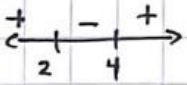
Dec: $(-\infty, 5) \rightarrow f'(x) < 0$

Min @ $x = 5 \rightarrow f'(x)$ Δs signs from − to +.

2) $g'(x) = f(x)f'(x)(x-2)$

$= -(4-x)(x-2) = 0$

$x = 4 \quad x = 2$



g is Dec: $(2,4)$ $g' < 0$

3) a) $f(x)$ has min @ $x = -1.922, 1.018$

$f(x)$ has max @ $x = -1.2502$

b) $f(x)$ has max @ $x = 7.389$ or e^2

c) $f(x)$ has max @ $x = 0.3016$

$f(x)$ has min @ $x = 2.467$

4) a) f has min @ $x = 2 \rightarrow f'$ Δs signs from − to +

f has max @ $x = -2 \rightarrow f'$ Δs signs from + to −

b) f has min @ $x = 1 \rightarrow f'$ Δs signs from − to +.

f has max @ $x = -2.5 \rightarrow f'$ Δs signs from + to −.