3.3 Increasing, Decreasing, and 1st Derivative Test

____ 1. Determine the increasing and decreasing open intervals of the function $f(x)=(x-3)^{4/5}(x+1)^{1/5}$ over its domain. Tip: factor out least powers from the derivative to put it into full-fledged-factored-form!

(A) Inc: $\left(-1,-\frac{1}{5}\right)$, Dec: $\left(-\frac{1}{5},\infty\right)$

(B) Inc: $\left(-1,-\frac{1}{5}\right)\cup(3,\infty)$, Dec: $\left(-\frac{1}{5},3\right)$

(C) Inc: $(-\infty,-1)\cup(3,\infty)$, Dec: $(-1,3)$

(D) Inc: $\left(-\infty,-\frac{1}{5}\right)\cup(3,\infty)$, Dec: $\left(-\frac{1}{5},3\right)$

(E) Inc: $\left(-\frac{1}{5},3\right)\cup(3,\infty)$, Dec: $\left(-1,\frac{1}{5}\right)\cup(3,\infty)$

3. Let $f(x)=x\left(4+x^2-\frac{x^4}{5}\right)$.

_____ (i) Which of the following is $f'(x)$?

(A) $f'(x)=\left(1+x^2\right)\left(5-x^2\right)$

(B) $f'(x)=\left(1+x^2\right)\left(4-x^2\right)$

(C) $f'(x)=\left(1-x^2\right)\left(5+x^2\right)$

(D) $f'(x)=\left(1-x^2\right)\left(4+x^2\right)$

(E) $f'(x)=\left(1-x^2\right)\left(4-x^2\right)$

_____ (ii) Find the open interval(s) on which f is increasing.

(A) $(-\infty,-2)\cup(2,\infty)$

(B) $\left(-\infty,-\sqrt{5}\right)\cup\left(\sqrt{5},\infty\right)$

(C) $(-2,2)$

(D) $(-\infty,-1)\cup(1,\infty)$

(E) $(-1,1)$

_____ 5. Which of the following statements about the absolute maximum and absolute minimum values of $f(x)=\dfrac{x^3-4x^2-6x-1}{x+1}$ on the interval $[0,\infty)$ are correct? (Hint: Think of what type of discontinuity does $f(x)$ have??? $\dfrac{0}{0}$ or $\dfrac{\neq 0}{0}$)

(A) Max $=13$, No Min

(B) No Max, Min $=-\dfrac{29}{4}$

(C) Max $=13$, Min $=-\dfrac{29}{4}$

(D) Max $=5$, No Min

(E) No Max, Min $=-1$

_____ 6. (**Calculator Permitted**) The first derivative of the function f is defined by $f'(x)=\cos\left(x^3-x\right)$ for $0\le x\le 2$. On what intervals is f increasing?

(A) $0\le x\le 1.445$ only

(B) $1.445\le x\le 1.875$

(C) $1.691\le x\le 2$

(D) $0\le x\le 1$ and $1.691\le x\le 2$

(E) $0\le x\le 1.445$ and $1.875\le x\le 2$

7. For each of the following, find the critical values (on the indicated intervals, if indicated.) Remember, a critical value MUST be in the domain of the function, though it may not be in the domain of the derivative.

(a) $f(x)=x^2(3-x)$ (b) $f(x)=\dfrac{\sin x}{1+\cos^2 x}$, $[0,2\pi]$ (c) $f(x)=\dfrac{x^2}{x^2-9}$