Derivatives - Part 2

Application of Derivatives

Q1. Find the behavior of each of the functions, whether the function f(x) increases, decreases in/around the values of x within the domain indicated, based on the first derivative (as done in the class).

For $x \in [-2, +2]$

a. $f(x) = 2 + (x - 2)^2$
b. $f(x) = (x)^{2/3}$
c. $f(x) = x^4$
d. $f(x) = x^3$
e. $f(x) = x^{1/3}$
f. $f(x) = x^{5/3}$
g. $f(x) = \frac{(1+x)^2}{1+x^2}$
h. $f(x) = \frac{4+x^2}{2x}$
i. $f(x) = x\sqrt{8 - x^2}$

Q2. Take x = -2, -1, 0, +1 and +2 for each of the cases above, and find using the first derivative, whether the graphs of the function above are concave-up or concave-down or neither.

Q3. Repeat question Q1 for the functions below. Also find the concavity of the functions below for each multiple of $\pi/4$ withing the domain $x \in [0, \pi]$

j. $f(x) = \sin(x)$
k. $f(x) = \sin(x + \pi)$
l. $f(x) = \cos(x + \pi/2)$
m. $f(x) = \tan(x - \pi/2)$
n. $f(x) = \sin(|x - \pi/2|)$

Q3. For each of the above functions given in questions Q1 and Q3, find minima, maxima (if they exist).

Q4. What can you say about the relation between the concavity and the second-derivative based on the answers to the above questions?