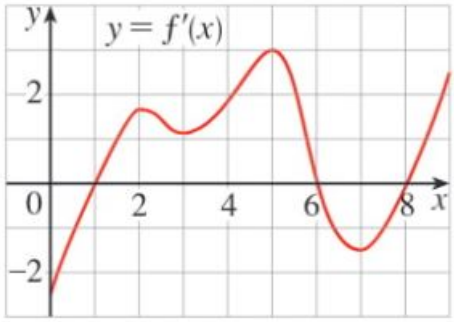
CSD1251/CSD1250 Homework 12

Due: 4th April 2023, 2359 HRS

For each question, key in **the** correct option into the homework into the "Homework 12" option in the "19 March to 25 March" section in our meta course page on Moodle.

Questions $1-2$ pertain to the graph of the **derivative** f' of a continuous function f, as shown below.



Question 1

Pick an interval where f is CU.

(a) $(0,1)$ (b) $(6,7)$ (c) $(4,7)$ (d) $(2,4)$ (e) None of these

Question 2

Pick an interval where f is CD.

(a) $(0,2)$ (b) $(5,6)$ (c) $(7,8)$ (d) $(3,4)$ (e) None of these

Question 3

Find the number of inflection points of $f(x) = \dfrac{x^5}{10} - \dfrac{x^4}{3}$.

(a) 4 (b) 3 (c) 2 (d) 1 (e) None of these

Question 4

A model used for the yield Y of an agricultural crop as a function of the nitrogen level N in the soil (measured in appropriate units) is

$$Y(N) = \frac{kN}{1+N^2}$$

where k is a positive constant. What is the highest possible yield of this crop?

(a) 0 (b) $\frac{k}{4}$ (c) $\frac{k}{2}$ (d) k (e) None of these

Question 5

Find the coordinates (x, y) on the line $y = 2x + 3$ that is closest to the origin $(0, 0)$.

(a) $(0, 3)$ (b) $(\frac{6}{5}, \frac{27}{5})$ (c) $(-\frac{6}{5}, \frac{3}{5})$ (d) $(1, 5)$ (e) None of these

Question 6

If a resistor of R ohms is connected across a battery of E volts with internal resistance r ohms, then the power (in watts, W) in the external resistor is

$$P = \frac{E^2 R}{(R+r)^2}.$$

If E and r are fixed but R varies, what is the maximum value of the power?

(a) $\frac{E^2}{4r}$ (b) 0 (c) $\frac{E^2}{2r}$ (d) E^2 (e) None of these

Question 7

A cylindrical can is to be made to hold 5000 cm^3 of oil. Find the height of the can that will minimize the cost of metal to manufacture.

(a) $2\sqrt[3]{\frac{1000}{\pi}}$ (b) $2\sqrt[3]{\frac{1500}{\pi}}$ (c) $2\sqrt[3]{\frac{2000}{\pi}}$ (d) $2\sqrt[3]{\frac{2500}{\pi}}$ (e) None of these