

NORTH SOUTH UNIVERSITY
DEPARTMENT OF MATHEMATICS & PHYSICS

ASSIGNMENT # 02

Spring 2022

Total Marks: 10

Course: MAT-120, Section - 11

Due: 23 April 2022 (Before 01: 00 pm)

- Important Notes:**
1. You have to answer all the questions **serially**.
 2. You must prepare it by your **hand writing**.
 3. Write page number and ID at the top of each page of your assignment.
 4. You have to solve the assignment with honesty and integrity.
 5. Submit the assignment soon once you complete it.
 6. You should not share your solutions with others.
 7. Use **A4** size papers and add this sheet after the cover page.
 8. Assignment will not be **accepted** after the due date.
 9. Your score will be **zero** for any copy or plagiarism and
 10. Must submit it as **hard copy** on or before my class.

Question 1: Let l be the length of a diagonal of a rectangle whose sides have lengths x and y , and assume that x and y vary with time.

(a) How are $\frac{dl}{dt}$, $\frac{dx}{dt}$ and $\frac{dy}{dt}$ related?

(b) If x increases at a constant rate of $\frac{1}{2}$ ft/s and y decreases at a constant rate of $\frac{1}{4}$ ft/s, how fast is the size of the diagonal changing when $x = 3$ ft and $y = 4$ ft? Is the diagonal increasing or decreasing at that instant?

Question 2: A spherical balloon is to be deflated so that its radius decreases at a constant rate of 15 cm/min. At what rate must air be removed when the radius is 9 cm?

Question 3: Find the following limit:

(a)

$$\lim_{x \rightarrow \pi/2^-} (\tan x)^{(\pi/2) - x}$$

(b)

$$\lim_{x \rightarrow 0^+} x^{\sin x}$$

(c)

$$\lim_{x \rightarrow 0} \left(\frac{1}{x^2} - \frac{\cos 3x}{x^2} \right)$$

(d)

$$\lim_{x \rightarrow 0} \frac{x - \tan^{-1} x}{x^3}$$

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Question 4: Find: **(a)** the intervals on which f is increasing, **(b)** the intervals on which f is decreasing, **(c)** the open intervals on which f is concave up, **(d)** the open intervals on which f is concave down, and **(e)** the x -coordinates of all inflection points.

(i) $f(x) = \frac{x}{x^2+2}$

(ii) $f(x) = x^{\frac{2}{3}} - x$

(iii) $f(x) = e^{-\frac{x^2}{2}}$

(iv) $f(x) = x^3 \ln x$

Question 5: Give a graph of the polynomial and label the coordinates of the intercepts, stationary points, and inflection points. Check your work with a graphing utility.

(a) $p(x) = 4x^3 - 9x^4$

(b) $p(x) = x^4 - 6x^2 + 5$

(c) $p(x) = x^2 - 3x - 4$

Question 6: Use any method to find the relative extrema of the following function:

(a) $f(x) = \sin 2x \quad 0 < x < \pi$

(b) $f(x) = \frac{x+3}{x-2}$

(c) $f(x) = x(x-4)^3$