

This file contains questions spanning CLP-1. It should not be taken as a complete review of the course, but rather as a jumping-off point. If you struggle with one question, go back to review its entire section. Sections are noted at the bottom of each page.

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S1

Find all solutions to  $x^3 - 3x^2 - x + 3 = 0$

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S2

Compute the limit  $\lim_{x \rightarrow 2} \frac{x - 2}{x^2 - 4}$

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S3

Find all values of  $c$  such that the following function is continuous:

$$f(x) = \begin{cases} 8 - cx & \text{if } x \leq c \\ x^2 & \text{if } x > c \end{cases}$$

Use the definition of continuity to justify your answer.

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S4

Compute

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$$\lim_{x \rightarrow -\infty} \frac{3x + 5}{\sqrt{x^2 + 5} - x}$$

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S5

Find the equation of the tangent line to the graph of  $y = \cos(x)$  at  $x = \frac{\pi}{4}$ .

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S6

For what values of  $x$  does the derivative of  $\frac{\sin(x)}{x^2 + 6x + 5}$  exist?

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S7

Find  $f'(x)$  if  $f(x) = (x^2 + 1)^{\sin(x)}$ .

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S8

Consider a function of the form  $f(x) = Ae^{kx}$  where  $A$  and  $k$  are constants. If  $f(0) = 3$  and  $f(2) = 5$ , find the constants  $A$  and  $k$ .

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S9

Consider a function  $f(x)$  which has  $f'''(x) = \frac{x^3}{10 - x^2}$ . Show that when we approximate  $f(1)$  using its second Maclaurin polynomial, the absolute error is less than  $\frac{1}{50} = 0.02$ .

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S10

Estimate  $\sqrt{35}$  using a linear approximation

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S11

Let  $f(x) = x^2 - 2\pi x - \sin(x)$ . Show that there exists a real number  $c$  such that  $f'(c) = 0$ .

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S12

Find the intervals where  $f(x) = \frac{\sqrt{x}}{x+6}$  is increasing.

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L1

Compute the limit  $\lim_{x \rightarrow 1} \frac{\sqrt{x+2} - \sqrt{4-x}}{x-1}$ .

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L2

Show that there exists at least one real number  $c$  such that  $2 \tan(c) = c + 1$ .

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L3

Determine whether the derivative of following function exists at  $x = 0$

$$f(x) = \begin{cases} 2x^3 - x^2 & \text{if } x \leq 0 \\ x^2 \sin\left(\frac{1}{x}\right) & \text{if } x > 0 \end{cases}$$

You must justify your answer using the definition of a derivative.

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L4

If  $x^2 \cos(y) + 2xe^y = 8$ , then find  $y'$  at the points where  $y = 0$ .  
You must justify your answer.

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L5

Two particles move in the cartesian plane. Particle A travels on the  $x$ -axis starting at  $(10, 0)$  and moving towards the origin with a speed of 2 units per second. Particle B travels on the  $y$ -axis starting at  $(0, 12)$  and moving towards the origin with a speed of 3 units per second. What is the rate of change of the distance between the two particles when particle A reaches the point  $(4, 0)$ ?

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L6

Find the global maximum and the global minimum for  
 $f(x) = x^3 - 6x^2 + 2$  on the interval  $[3, 5]$ .

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