

MATH 1013: Applied Calculus I

Assignment 3 - 20 marks total
due Sunday, July 11th (11:59pm)

Submission Instructions. Complete any FOUR (4) of the 6 questions below, each worth 5 marks. Your submission will be graded both on accuracy and clear and effective communication (mathematical, non-mathematical, written and visual). If you submit more than 4 solutions, we will grade the first four you submit.

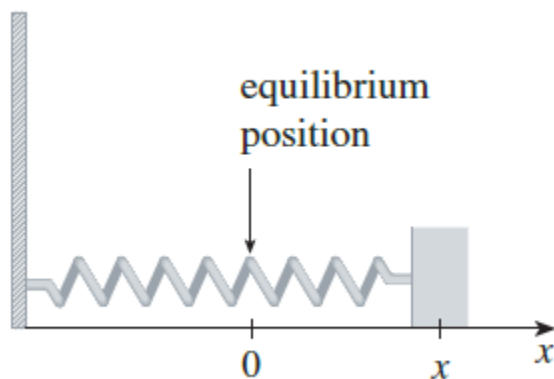
You may consult with other classmates for inspiration, but your final submission must be written in your own words with your own thoughts and ideas.

(5 marks) (1):

A mass on a spring vibrates horizontally on a smooth level surface (see the figure). Its equation of motion is $x(t) = 8 \sin t$, where t is in seconds and x in centimeters.

(a) Find the velocity and acceleration at time t .

(b) Find the position, velocity, and acceleration of the mass at time $t = 2\pi/3$. In what direction is it moving at that time?



(5 marks) (2):

(a) Find an equation of the tangent line to the curve at the given point.

(1) $y = \sin x + \cos x$, $(0,1)$ (2) $y = x + \sin x$, (π, π)

(3) $y = e^x \cos x + \sin x$, $(0,1)$ (4) $y = \frac{1+\sin x}{\cos x}$, $(\pi, -1)$

(5 marks) (3):

Find the derivative of the function

$$f(x) = (2x^3 - 5x^2 + 4)^5 \qquad f(t) = \left(\frac{1}{2t+1}\right)^4$$

$$g(x) = e^{x^2-x} \qquad f(t) = t \sin \pi t \qquad g(\theta) = \cos^2 \theta$$

(5 marks) (4):

Find the limit or show that it does not exist.

$$(a) \lim_{t \rightarrow -\infty} (\sqrt{25t^2 + 2} - 5t) \qquad (b) \lim_{x \rightarrow \infty} (\sqrt{x^2 + ax} - \sqrt{x^2 + bx})$$

$$(c) \lim_{x \rightarrow -\infty} (x^2 + 2x^7) \qquad (d) \lim_{t \rightarrow \infty} \frac{t+3}{\sqrt{2t^2-1}} \qquad (e) \lim_{x \rightarrow \infty} \frac{-2}{3x+7}$$

(5 marks) (5):

Find y' and y''

$$(a) y = \cos(\sin \theta) \qquad (b) y = (1 + \sqrt{x})^3 \qquad (c) y = \sqrt{\cos x} \qquad (d) y = e^{e^x}$$

(6) (5 marks) Find dy/dx by implicit differentiation.

$$(a) x^2 - 4xy + y^2 = 4 \qquad (b) 2x^2 + xy - y^2 = 2$$
$$(c) x^4 + x^2y^2 + y^3 = 5 \qquad (d) x^3 - xy^2 + y^3 = 1$$

Good Luck