Paul's Online Notes

ASSIGNMENT PROBLEMS NOTICE

Please do not email me to get solutions and/or answers to these problems. I will not give them out under any circumstances nor will I respond to any requests to do so. The intent of these problems is for instructors to use them for assignments and having solutions/answers easily available defeats that purpose.

Section 2.1 : Tangent Lines And Rates Of Change - Assignment Problems

1. For the function $f(x) = x^3 - 3x^2$ and the point P given by $x = 3$ answer each of the following questions.

(a) For the points Q given by the following values of x compute (accurate to at least 8 decimal places) the slope, m_{PQ}, of the secant line through points P and Q.

(i) 3.5 **(ii)** 3.1 **(iii)** 3.01 **(iv)** 3.001 **(v)** 3.0001

(vi) 2.5 **(vii)** 2.9 **(viii)** 2.99 **(ix)** 2.999 **(x)** 2.9999

(b) Use the information from (a) to estimate the slope of the tangent line to $f(x)$ at $x = 3$ and write down the equation of the tangent line.

2. For the function $g(x) = \dfrac{x}{x^2 + 4}$ and the point P given by $x = 0$ answer each of the following questions.

(a) For the points Q given by the following values of x compute (accurate to at least 8 decimal places) the slope, m_{PQ}, of the secant line through points P and Q.

(i) 1 **(ii)** 0.5 **(iii)** 0.1 **(iv)** 0.01 **(v)** 0.001

(vi) -1 **(vii)** -0.5 **(viii)** -0.1 **(ix)** -0.01 **(x)** -0.001

(b) Use the information from (a) to estimate the slope of the tangent line to $g(x)$ at $x = 0$ and write down the equation of the tangent line.

3. For the function $h\left(x\right) = 2 - \left(x + 2\right)^2$ and the point P given by $x = -2$ answer each of the following questions.

(a) For the points Q given by the following values of x compute (accurate to at least 8 decimal places) the slope, m_{PQ}, of the secant line through points P and Q.

(i) -2.5 **(ii)** -2.1 **(iii)** -2.01 **(iv)** -2.001 **(v)** -2.001

(vi) -1.5 **(vii)** -1.9 **(viii)** -1.99 **(ix)** -1.999 **(x)** -1.9999

(b) Use the information from (a) to estimate the slope of the tangent line to $h\left(x\right)$ at $x = -2$ and write down the equation of the tangent line.

4. For the function $P\left(x\right) = \mathbf{e}^{2-8x^{\,2}}$ and the point P given by $x = 0.5$ answer each of the following questions.

(a) For the points Q given by the following values of x compute (accurate to at least 8 decimal places) the slope, m_{PQ}, of the secant line through points P and Q.

(i) 1 **(ii)** 0.51 **(iii)** 0.501 **(iv)** 0.5001 **(v)** 0.50001

(vi) 0 **(vii)** 0.49 **(viii)** 0.499 **(ix)** 0.4999 **(x)** 0.49999

(b) Use the information from (a) to estimate the slope of the tangent line to $h\left(x\right)$ at $x = 0.5$ and write down the equation of the tangent line.

5. The amount of grain in a bin is given by $V\left(t\right) = \dfrac{11t + 4}{t + 4}$ answer each of the following questions.

(a) Compute (accurate to at least 8 decimal places) the average rate of change of the amount of grain in the bin between $t = 6$ and the following values of t.

(i) 6.5 **(ii)** 6.1 **(iii)** 6.01 **(iv)** 6.001 **(v)** 6.0001

(vi) 5.5 **(vii)** 5.9 **(viii)** 5.99 **(ix)** 5.999 **(x)** 5.9999

(b) Use the information from (a) to estimate the instantaneous rate of change of the volume of grain in the bin at $t = 6$.

6. The population (in thousands) of insects is given by $P(t) = 2 - \frac{1}{\pi}\cos(3\pi t)\sin\left(\frac{\pi t}{2}\right)$ answer each of the following questions.

(a) Compute (accurate to at least 8 decimal places) the average rate of change of the population of insects between $t = 4$ and the following values of t. Make sure your calculator is set to radians for the computations.

(i) 4.5 **(ii)** 4.1 **(iii)** 4.01 **(iv)** 4.001 **(v)** 4.0001

(vi) 3.5 **(vii)** 3.9 **(viii)** 3.99 **(ix)** 3.999 **(x)** 3.9999

(b) Use the information from (a) to estimate the instantaneous rate of change of the population of the insects at $t = 4$.

7. The amount of water in a holding tank is given by $V(t) = 8t^4 - t^2 + 7$ answer each of the following questions.

(a) Compute (accurate to at least 8 decimal places) the average rate of change of the amount of grain in the bin between $t = 0.25$ and the following values of t.

(i) 1 **(ii)** 0.5 **(iii)** 0.251 **(iv)** 0.2501 **(v)** 0.25001

(vi) 0 **(vii)** 0.1 **(viii)** 0.249 **(ix)** 0.2499 **(x)** 0.24999

(b) Use the information from (a) to estimate the instantaneous rate of change of the volume of water in the tank at $t = 0.25$.

8. The position of an object is given by $s(t) = x^2 + \frac{72}{x+1}$ answer each of the following questions.

(a) Compute (accurate to at least 8 decimal places) the average velocity of the object between $t = 5$ and the following values of t.

(i) 5.5 **(ii)** 5.1 **(iii)** 5.01 **(iv)** 5.001 **(v)** 5.0001

(vi) 4.5 **(vii)** 4.9 **(viii)** 4.99 **(ix)** 4.999 **(x)** 4.9999

(b) Use the information from (a) to estimate the instantaneous velocity of the object at $t = 5$ and determine if the object is moving to the right (*i.e.* the instantaneous velocity is positive), moving to the left (*i.e.* the instantaneous velocity is negative), or not moving (*i.e.* the instantaneous velocity is zero).

9. The position of an object is given by $s(t) = 2\cos(4t-8) - 7\sin(t-2)$. Note that a negative position here simply means that the position is to the left of the "zero position" and is perfectly acceptable. Answer each of the following questions.

(a) Compute (accurate to at least 8 decimal places) the average velocity of the object between $t = 2$ and the following values of t. Make sure your calculator is set to radians for the computations.

(i) 2.5 **(ii)** 2.1 **(iii)** 2.01 **(iv)** 2.001 **(v)** 2.0001

(vi) 1.5 **(vii)** 1.9 **(viii)** 1.99 **(ix)** 1.999 **(x)** 1.9999

(b) Use the information from (a) to estimate the instantaneous velocity of the object at $t = 2$ and determine if the object is moving to the right (*i.e.* the instantaneous velocity is positive), moving to the left (*i.e.* the instantaneous velocity is negative), or not moving (*i.e.* the instantaneous velocity is zero).

10. The position of an object is given by $s(t) = t^2 - 10t + 11$. Note that a negative position here simply means that the position is to the left of the "zero position" and is perfectly acceptable. Answer each of the following questions.

(a) Determine the time(s) in which the position of the object is at $s = -5$.

(b) Estimate the instantaneous velocity of the object at each of the time(s) found in part (a) using the method discussed in this section.

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