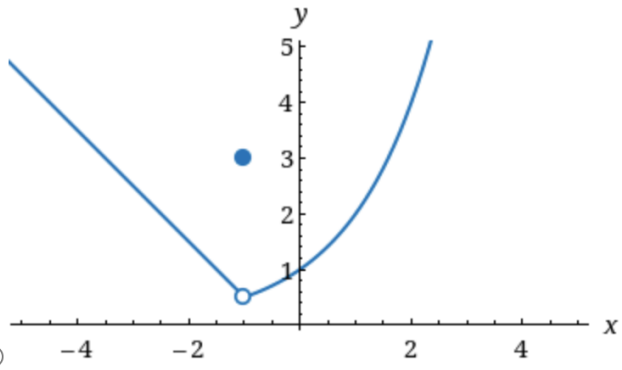
EXAM 2 # TMath 124 Spring 2024

Show *all* your work (numerically, algebraically, or geometrically) for the following problems. Supporting work is needed to earn credit.

1. Let $f(x) = \sin(\pi x)$.
   The graph of g is given on the right. Estimate (if possible):



   (a) [1] (TrigPractice#4) $f(-2)$

   (b) [2] (ProductActivity #1) $\frac{d}{dx}(g(x))|_{x=-2}$.

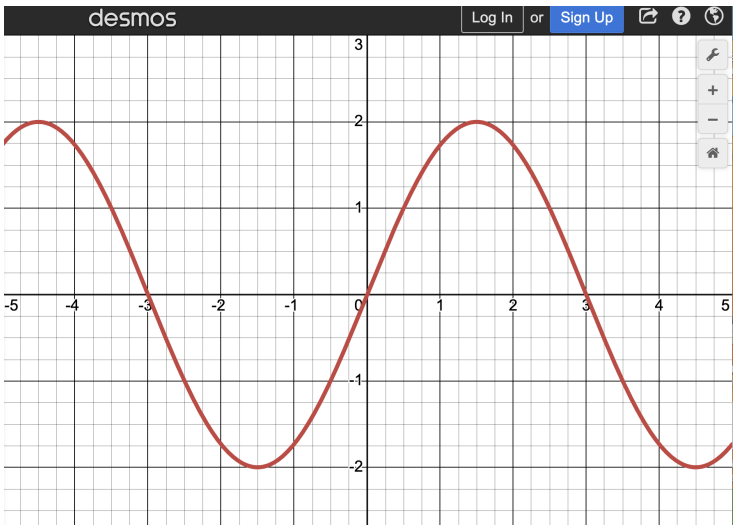
   (c) [2] an x value where $g'(x) \approx 2$

   (d) [3] (WebHW8#7) $\dfrac{d}{dx}\left(f(x)g(x)\right)|_{x=-2}$

   (e) [3] (§3.4 #72) $(f \circ g)'(0)$

2. [2] (PracticeExam2#1) Find $\lim_{x \to 0} \dfrac{\sin(7\theta)}{\theta}$ (either numerically, graphically, or algebraically), if it exists.

3. Consider a particle that is moving with *velocity* is $v(t) = 2\sin\left(\dfrac{\pi t}{3}\right)$ (inches per second), graphed on the right.



(a) [1] Find the velocity when $t = 1$.

(b) [2] (WordProblem2#3) Find 2 times that the particle is at rest?

(c) [3] (WordProblem2#3) Find the acceleration as a function of t.

(d) [3] (§3.3 #40) Find a time when the acceleration is -1(inch per second squared).

4. [3] (WebHW9#7 or WebHW8#1) Find $\frac{dy}{dx}$ of *ONE* of the listed functions below. Doing both does not earn extra credit and only one will be marked so clearly indicate what you want marked!

$y = \left(\frac{1}{x^3} + 3\right) e^x$ $\qquad$ $y = \frac{x + 7\sqrt{x}}{\cos(x)}$

5. The differentiable functions f and g are defined for all real numbers. Values for f, f', g, and g' for various x values are given in the table.

x	$f(x)$	$f'(x)$	$g(x)$	$g'(x)$
1	3	4	2	6
2	1	5	8	7
3	7	7	2	9

(a) [1] Find $g(2)$.

(b) [3] (WebHW11#10) Find the linearization of g at $x = 2$.

(c) [1] (§3.10#52a) Use the linearization of g to approximate $g(2.05)$.

(d) [1] (ImplicitDifActivity#5)Given that $h(x) = [f(x)]^{g(x)}$, find $h(1)$.

(e) [4] (ImplicitDifActivity#5)Given that $h(x) = [f(x)]^{g(x)}$, find $h'(1)$.

6. [5] (WebHW10#8 or PracticeExam2#4) Find $\frac{dy}{dx}$ of *ONE* of the listed functions below. Doing both does not earn extra credit and only one will be marked so clearly indicate what you want marked!

$y = \dfrac{4^x \cdot \log_4(x)}{x^2 - 4x}$ $\qquad\qquad$ $y + x8^y = \ln(x)$

7. Suppose there is an oil spills that is spreading in a cylindrical pattern that has uniform thickness of .001meters. On day 9 the area of the spill area was 13,000km^2 and the radius of the spill was increasing by about 10 meters a day.

   (a) [2] (WebHW11 #1)Find a function for the *rate the volume* is changing as a function of the radius r, and the rate of change of r.

   (b) [3] (RelatedRatesActivity#2) Find the rate that the volume was changing on the 9th day. Clearly identify what it is you are looking for in calculus notation.