EXAM 1 # TMath 124 Winter 2021

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

1. [8] Find the limits (either numerically, graphically, or algebraically) if they exist:

   (a) $\lim_{x\to 0} x^2 \cos\left(\frac{1}{x^2}\right)$

   (b) $\lim_{h\to 0} \frac{\frac{1}{(3+h)^2} - \frac{1}{9}}{h}$

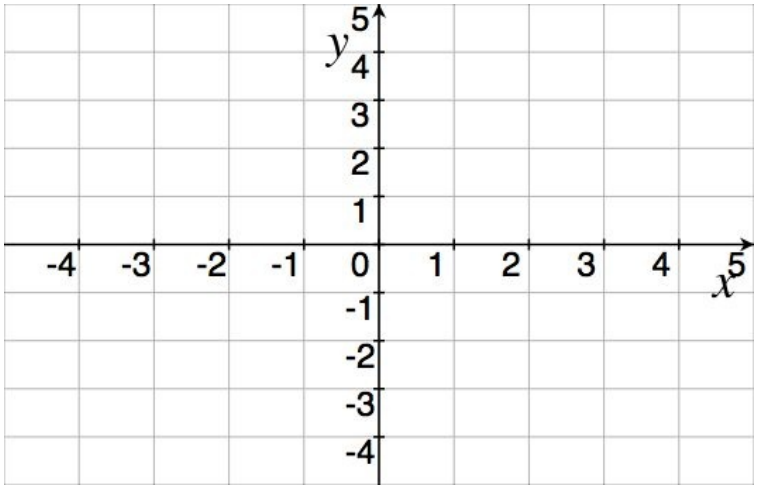
2. [5] Draw a graph for a function $\alpha(x)$, that satisfies all of the following:

   (a) $\lim_{x\to -2} \alpha(x) = \infty$,

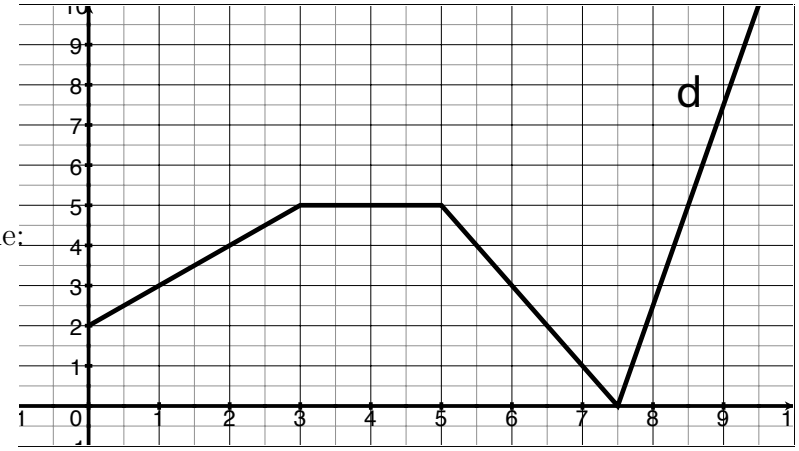
   (b) α is continuous on the interval $(-2, 3)$,

   (c) $\alpha(3) = -1$, and

   (d) $\lim_{x\to 3^-} \alpha(x) = 2$.



3. The following graph is a function, d, that returns the distance (in feet) a fly is from a spider web after t seconds.



(a) [2] How close does the fly get to the web and when?

(b) [5] Estimate the following, if possible:

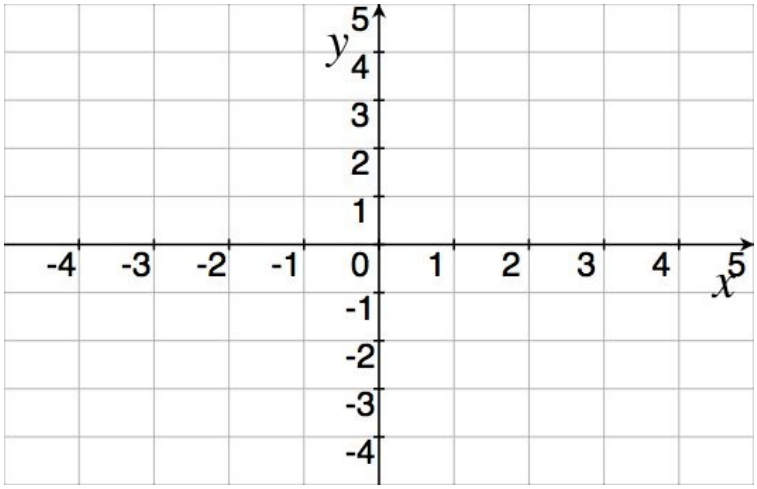
$\lim_{t\to 3}(2d(t)-4)$

$d(6)$

$\frac{d}{dt}d|_{t=6}$

(c) [3] What is the speed of the fly when $t = 6$ and is the fly moving towards or away from the web?

4. [5] Draw a graph for a function $\beta(x)$, that satisfies all of the following:



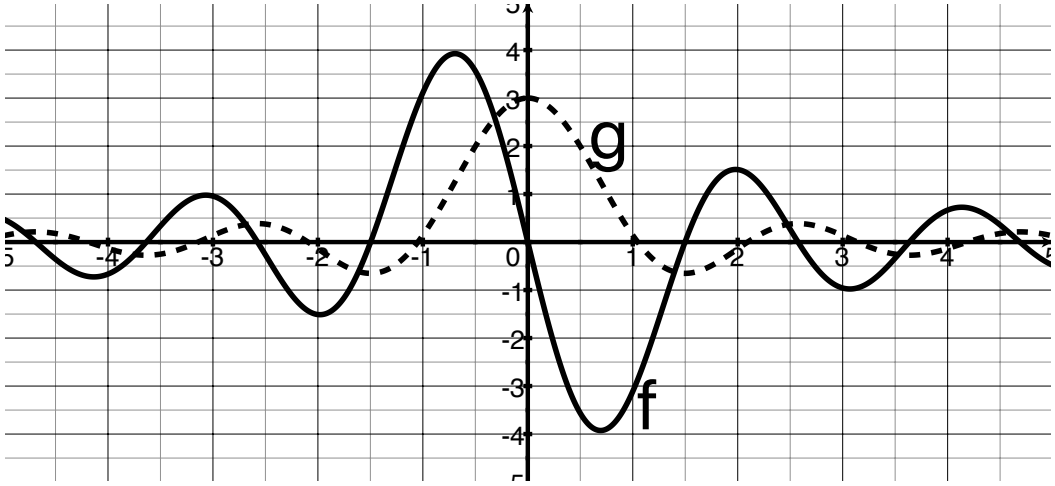
(a) $\lim_{x\to\infty}\beta(x) = 2$,

(b) β is continuous on the interval $(-2, 3)$,

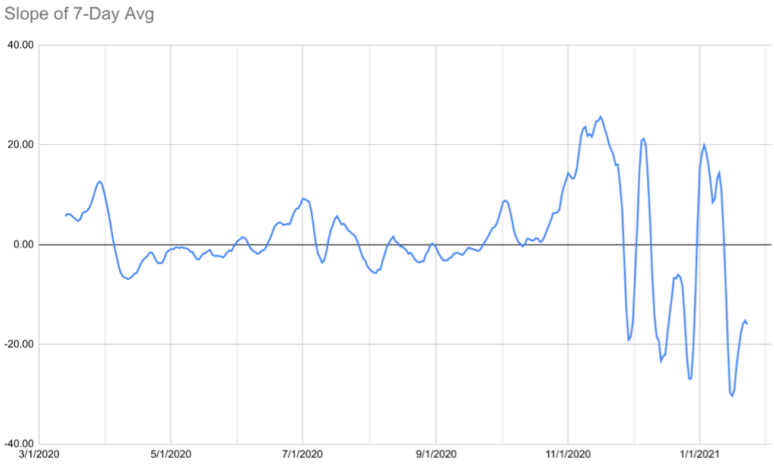
(c) $\beta'(1)$ does not exist, and

(d) $\beta'(x) > 0$ when $x < 0$.

5. [3] Consider the graph of f and g shown below. One graph is the derivative of the other, that is, either $f'(x) = g(x)$ or $g'(x) = f(x)$. Determine which it is an explain/justify your choice!



6. Use the graph provided by JCRooks on CoronavirusWA Reddit on Jan 24th duplicated below. JCRooks is plotting the Slope of the 7-day average of new Covid-19 cases in King County over time.

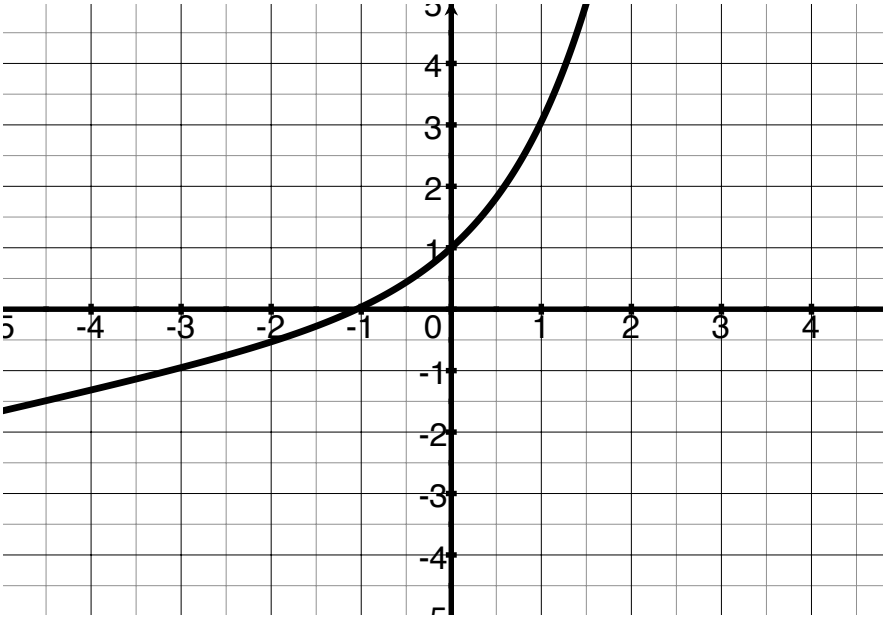


(a) [2] Describe what is happening to the 7-day average of new Covid-19 cases in King County now.

(b) [3] Identify a time that the 7-day average of new Covid-19 cases peaked. Explain/justify your answer.

(c) [2] Why do you think JCRooks provided this graph as opposed to the graph of Covid-19 cases directly?

7. Consider $f(x) = \frac{1}{3}x + e^x$ graphed to the right.



   (a) [3] Find $\frac{df}{dx}$

   (b) [1] Sketch the line tangent to f when $x = 0$.

   (c) [4] Find the equation of the line sketched in part b. That is, find the equation of the line tangent to f when $x = 0$.

8. [4] Choose a problem from this exam that you've already answered,

   (a) show a second way of approaching/building a solution, and

   (b) explain why you did not choose this second method initially.