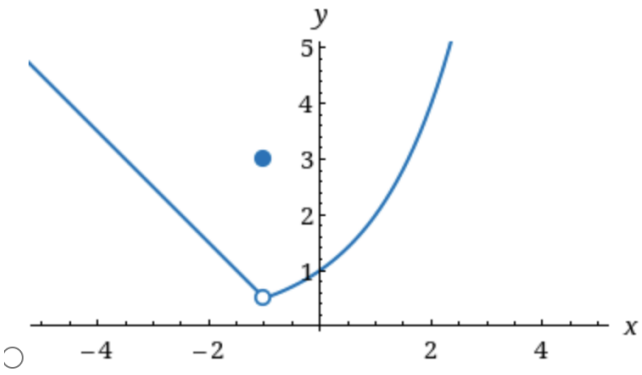
EXAM 1 **TMath 124** Spring 2024

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

1. Let $f(x) = \frac{5-2x}{x-2}$.
   The graph of g is given on the right. Estimate:



   (a) [1] (LimitActivity#1) $f(-1)$.

   (b) [2] (Quiz1#1) $g(-1) + \lim_{x\to -1} g(x)$

   (c) [2] (WebHW4#10) $\lim_{x\to\infty} f(x)$

   (d) [3] (§2.3#2) $\lim_{x\to 1}(f(x)g(x))$

   (e) [1] (§2.5 #20) Where f is *not* continuous.

   (f) [2] (Quiz2#1) $g'(-3)$

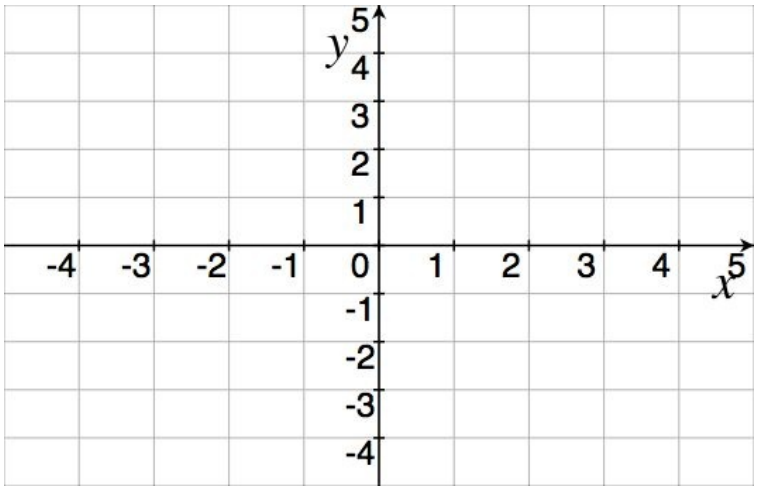
2. [5] (Quiz1#2) Draw one graph for a function $\alpha(x)$, that satisfies all of the following:

   (a) $\lim_{x\to 3} \alpha(x) = -\infty$,

   (b) α is not continuous when $x = 1$,

   (c) $\alpha(-2) = 1$, and

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



3. [4] (Practice Exam#8) Let $f(x) = x^2 - 5$. Find the limit (either numerically, graphically, or algebraically), if it exists, of $\lim_{h \to 0} \dfrac{f(1+h) - f(1)}{h}$

4. [3] (WebHW4#9) Let $f(x) = x^2 \left(1 - \cos\left(\dfrac{1}{x}\right)\right)$. Find the limit (either numerically, graphically, or algebraically), if it exists, of $\lim_{x \to 0} f(x)$

5. [3] (§2.7 #28) If the tangent line to $y = f(x)$ at $(1, 3)$ passes through the point $(5, 2)$ find the following.

   (a) $f(1)$

   (b) $f'(1)$

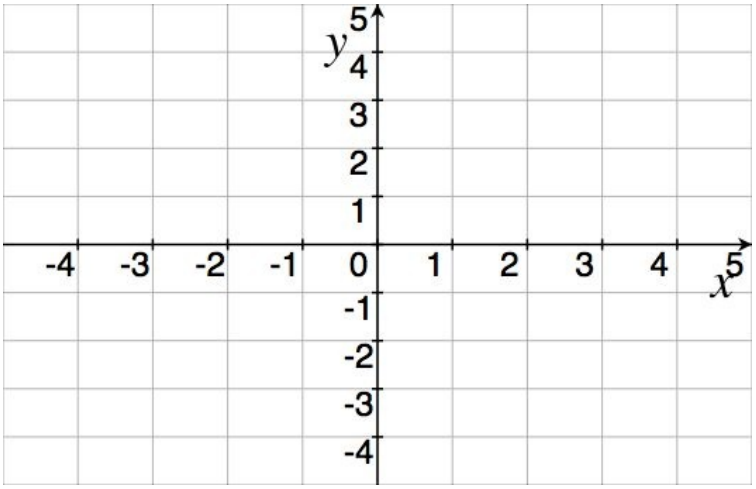
6. [5] (WebHW5#8) Draw one graph for a function $\beta(x)$, that satisfies all of the following:

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

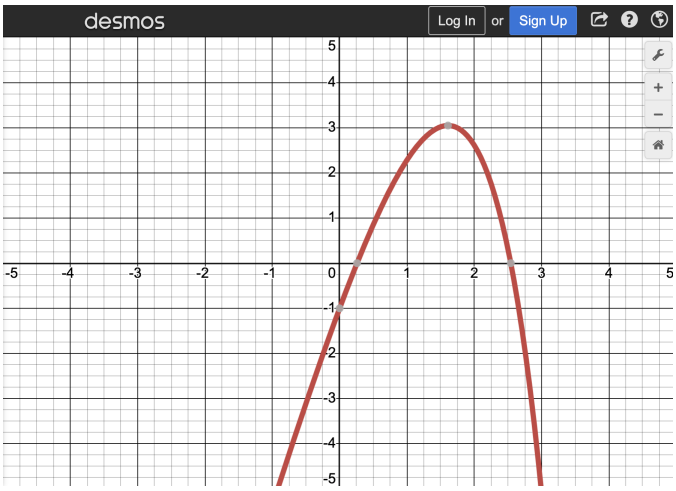
   (b) β is continuous on the interval $[-4, 4]$,

   (c) $\beta'(0)$ does not exist, and

   (d) $\frac{d}{dx}\beta|_3 = 1$.



7. Consider $f(x) = -e^x + 5x$ graphed to the right.



   (a) [3] (WebHW7#9) Find $\dfrac{df}{dx}$

   (b) [1] (DerivativeActivity#5) Estimate when $f'(x) = 0$

   (c) [4] (ExpActivity#4) Find the equation of the line tangent to f that is parallel to the line $y = 4x + 7$

8. (StoryProblems #6) A rock thrown upwards on planet Mars with velocity $15\frac{\text{m}}{\text{s}}$ has a height
$h(t) = 15t - 1.86t^2$ meters t seconds later.

   (a) [2] Find a velocity function that describes the velocity of the rock at t seconds.

   (b) [2] Recall gravity is the constant acceleration experienced by an object from the planet. Find the gravity on Mars.

   (c) [2] *When* does the rock reach its maximum height? Provide evidence.