#1. A tank holds 1000 gallons of water, which drains from the bottom of the tank in half an hour. The values in the table show the volume \( V \) of water remaining in the tank (in gallons) after \( t \) minutes. (So, \( V \) is a function of \( t \).) If \( P \) is the point \((10, 465)\) on the graph of \( V \), find the slope of the secant line \( PQ \) when \( Q \) is the point on the graph with \( t = 20 \).

<table>
<thead>
<tr>
<th>( t ) (min)</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V ) (gal)</td>
<td>652</td>
<td>465</td>
<td>284</td>
<td>174</td>
<td>17</td>
<td>0</td>
</tr>
</tbody>
</table>

Choose the best answer from the following (The units of your answer will be “gal/min.”):

A. 29  B. 46.5  C. -29  D. 0.0344827586  E. -46.5  
F. 21.3  G. NOTA

#2. We know that \( \lim_{x \to 1} \frac{1}{(x-1)^2} = \infty \), so if we have \( M = 100 \) assigned, for which choice of \( \delta \), below, is it true that \( \frac{1}{(x-1)^2} > M = 100 \) whenever \( 0 < |x-1| < \delta \) ?

A. \( \delta = \frac{1}{2} \)  B. \( \delta = \frac{1}{3} \)  C. \( \delta = \frac{1}{4} \)  D. \( \delta = \frac{1}{5} \)  E. \( \delta = \frac{1}{10} \)  F. NOTA.
#3. If \( f(x) \) is a function such that \( \frac{-1}{2} x^2 + x + \frac{3}{2} \leq f(x) \leq \frac{1}{10} x^2 - \frac{1}{5} x + \frac{21}{10} \) for all \( x \in \mathbb{R} \), then I want you to find \( \lim_{x \to 1} f(x) \).

Answer:
A. DNE  B. 2  C. 14  D. 7  E. 0  F. -14  G. NOTA

#4. How close to 6 do we have to take \( x \) so that \( \frac{1}{2} x - 4 \) is within a distance of 0.01 from -1?

Choose the best answer from these:
A. \( |x - 6| < 0.1 \)  B. \( |x - 6| < 0.02 \)
   
   C. \( |x - 6| < 0.3 \)  D. \( |x - 6| < 0.04 \)
#5. Use the given graph of \( y = \frac{1}{5} (x - 5)^2 \) to find a number \( \delta \) such that

\[
\left| \frac{1}{5} (x - 5)^2 - 1.8 \right| < 1 \quad \text{whenever} \quad |x - 2| < \delta
\]
Given that \( \lim_{x \to a} f(x) = 5 \), \( \lim_{x \to a} g(x) = -12 \), \( \lim_{x \to a} v(x) = 0 \), find the limits that exist. If the limit does not exist, explain why. (You do not have to state each Limit Law as you use it in this problem. That is, you may use the DSP, but do show me the arithmetic.)

1. \( \lim_{x \to a} \left( f(x) - 2g(x) \right) \)
2. \( \lim_{x \to a} \frac{1}{2} \left( \frac{f(x) + 3v(x)}{g(x)} \right) \)
3. \( \lim_{x \to a} \left( \frac{g(x)}{f(x)} \right)^2 \)
#7. You can use the Limit Laws and possibly some algebra, where applicable, to evaluate the limit, if it exists. If the limit does not exist, please state “DNE.”

\[
\lim_{h \to 0} \frac{\sqrt{4 + h} - 2}{h}
\]
#8. Prove, using the $\varepsilon, \delta$ - method, that $\lim_{x \to -2} (4x + 1) = -7$. 
#9. [ This is a calculator problem. However, please SHOW ME THE SET-UP as well as your CALCULATOR ANSWER. The answers “work-out,” so that no round-off is necessary or required. ]

A ball is thrown into the air with a velocity of 45 fps (feet per second). Its height \( h \) (in feet) after \( t \) seconds is given by

\[
h = 45t - 16t^2
\]

Find the average velocity of the ball for the time period beginning when \( t = \frac{1}{2} \) sec. and lasting 1 second.
#10.  [1]. Neatly draw the graph of the following piecewise function. (Use a straightedge, label both the axes, and show me a scale on each axis.)

$$f(x) = \begin{cases} 
2x & \text{if } x \leq 3 \\
6 & \text{if } x > 3 
\end{cases}$$

[2]. By inspection of the graph you have drawn, determine

(i) \( \lim_{x \to 3^-} f(x) \)  (ii) \( \lim_{x \to 3^+} f(x) \)  (iii) \( \lim_{x \to 3} f(x) \)
PART 3 (Bonus): (10 points. PC) Show your work.

BONUS: Prove, using the \( \varepsilon, \delta \) – method, that \( \lim_{x \to 2} x^2 + 2x + 3 = 11 \).