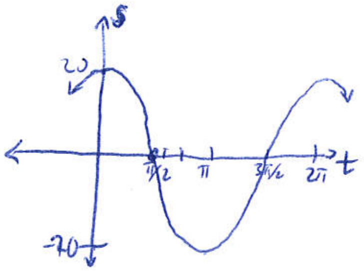
Answer Key

Math 180
Worksheet 1
Section 2.1-2.2

1.) Consider the position function $s(t) = 20\cos t$. Make a table of average velocities (hint: over smaller and smaller intervals) and use this to make a conjecture about the instantaneous velocity at $t = \pi/2$

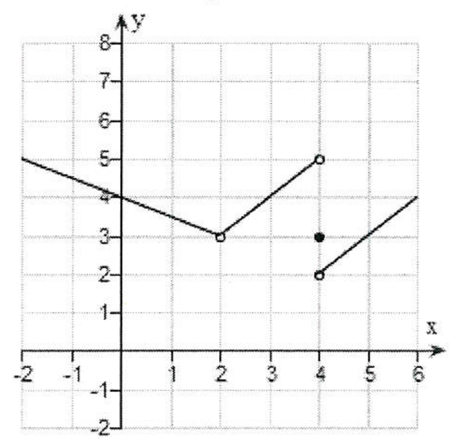


$s(\pi/2) = 20\cos(\frac{\pi}{2}) = 0$

t	$s(t)$	$\frac{s(t)-0}{t-\frac{\pi}{2}}$ = aver. vel.
$\frac{3\pi}{2}$	$20(0)$	$\frac{0-0}{\frac{3\pi}{2}-\frac{\pi}{2}} = \frac{0}{\pi} = 0$
π	$20(-1)$	$\frac{-20-0}{\pi-\frac{\pi}{2}} = \frac{-20}{(\frac{\pi}{2})} = \frac{-40}{\pi}$
$\frac{3\pi}{4}$	$20(\frac{-1}{\sqrt{2}})$	$\frac{\frac{-20}{\sqrt{2}}-0}{\frac{3\pi}{4}-\frac{\pi}{2}} = \frac{(\frac{-20}{\sqrt{2}})}{(\frac{\pi}{4})} = \frac{-80}{\sqrt{2}\pi} = \frac{-40\sqrt{2}}{\pi}$
$\frac{2\pi}{3}$	$20(\frac{-1}{2})$	$\frac{-10-0}{\frac{2\pi}{3}-\frac{\pi}{2}} = \frac{-10}{(\frac{\pi}{6})} = \frac{-60}{\pi}$

I conjecture the instantaneous velocity at $t = \frac{\pi}{2}$ is slightly more negative (or less than) $\frac{-60}{\pi}$.

2.) Consider the graph of $h(x)$ below. Find each of the following values or state that they do not exist.



a. $h(2)$ D.N.E.   b. $\lim_{x\to 2} h(x)$ 3   c. $h(4)$ 3   d. $\lim_{x\to 4} h(x)$ D.N.E

From here down is ~~[illegible]~~ unnecessary

since $2 = \lim_{x\to 4^+} h(x) \neq \lim_{x\to 4^-} h(x) = 5$

since the filled in dot over $x=4$ is at $y=3$

See how the function approaches $3=y$ as x approaches 2

since there is an open circle & no filled in circles above $x=2$

3.) Let $g(r) = \frac{r-100}{\sqrt{r}-10}$. Use a table of values to make a conjecture about $\lim_{r\to 100} g(r)$. Consider both one-sided limits in your work.

Need $\sqrt{r}$ to be an integer so we use $\cancel{1, 4, 9, 16, 25, 36}, 49, 64, 81, \cancel{100}, 121, 144, 169$

$\cancel{1^2, 2^2, 3^2, 4^2, 5^2, 6^2}, 7^2, 8^2, 9^2, \cancel{10^2}, 11^2, 12^2, 13^2$

r	$g(r)$
49	$\frac{49-100}{\sqrt{49}-10} = \frac{-51}{7-10} = \frac{-51}{-3} = \frac{51}{3} = 17$
64	$\frac{64-100}{\sqrt{64}-10} = \frac{-36}{8-10} = \frac{-36}{-2} = 18$
81	$\frac{81-100}{\sqrt{81}-100} = \frac{-19}{9-10} = \frac{-19}{-1} = 19$
121	$\frac{121-100}{\sqrt{121}-10} = \frac{21}{11-10} = \frac{21}{1} = 21$
144	$\frac{144-100}{\sqrt{144}-10} = \frac{44}{12-10} = \frac{44}{2} = 22$
169	$\frac{169-100}{\sqrt{169}-10} = \frac{69}{13-10} = \frac{69}{3} = 23$

I conjecture that $\lim_{r\to 100} g(r) = 20$

4.) Sketch the graph of a function with the given properties. You do not need to find a formula for the function. (There may be multiple possibilities).

$$h(-1) = 2, \quad \lim_{x\to -1^-} h(x) = 0, \quad \lim_{x\to -1^+} h(x) = 3,$$
$$\lim_{x\to 1^-} h(x) = 1, \quad \lim_{x\to 1^+} h(x) = 4$$

There are infinitely many possible correct graphes. Here is one.