Name: Solutions _____ / 25

There are 25 points possible on this quiz. *You should be able to complete it without using your notes or textbook – this is practice for your exams!* If you needed to look something up, you might want to come talk to me about questions you might have. **Show all work for full credit** and use some words or sentences to help communicate your answers.

1. [11 points] The point $P = (2,1)$ is a point on the graph of $f(x) = \frac{x}{3-x} - 1$.

a. Find the slope of the secant line passing through P and the point $Q = (0, f(0))$. Show some work.

$f(0) = \frac{0}{3-0} - 1 = -1$, so slope $= \frac{-1-1}{0-2} = \frac{-2}{-2} = 1$

so $Q = (0, -1)$

Slope = 1

b. Find the slope of the secant line passing through P and the point $R = (1, f(1))$. Show some work.

$f(1) = \frac{1}{3-1} - 1 = \frac{1}{2} - 1 = -\frac{1}{2}$ so $R = (1, -\frac{1}{2})$

Slope $= \frac{-\frac{1}{2} - 1}{1-2} = \frac{-3/2}{-1} = \frac{3}{2}$

Slope = 3/2

c. The table below lists the slope of the secant line passing through the point P and the point $S = (x, f(x))$ for several values of x. The value m_{sec} is the slope of the secant line.

x	1.9	1.99	1.999	2.001	2.01	2.1
$f(x)$	0.727273	0.970297	0.997003	1.003	1.0303	1.33333
m_{sec}	2.72727	2.97030	2.99700	3.00300	3.03030	3.33333

Use the information in the table to estimate the slope of the tangent line to $f(x)$ at the point $P = (2,1)$.

Tangent line slope = 3

d. Use the slope from part (c) above to write an equation of the tangent line at point $P = (2,1)$. You may write the equation of the line in whatever form you choose.

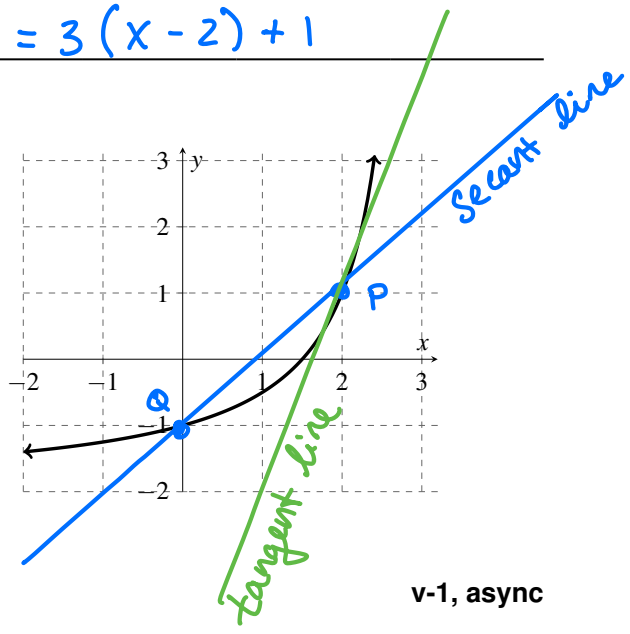
Tangent line equation: $y = 3(x-2) + 1$

e.

To the right is a sketch of part of the graph of

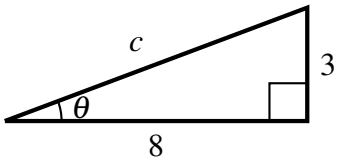
$$f(x) = \frac{x}{3-x} - 1.$$

Sketch and label the **tangent** line to the graph at the point $P = (2,1)$.
Sketch and label the **secant** line between $P = (2,1)$ and $Q = (0, f(0))$.



2. [2 points] Use the right triangle below, with side lengths 8, 3 and missing value c, to evaluate the expressions. Give your answers as exact numbers.

$c^2 = 8^2 + 3^2 = 64 + 9 = 73 \Rightarrow c = \sqrt{73}$

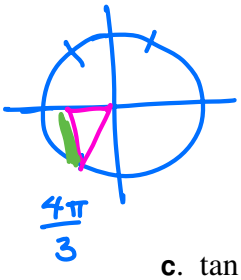


a. $\tan(\theta) = \frac{opp}{adj} = \frac{3}{8}$

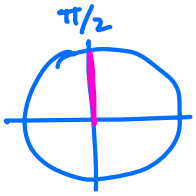
b. $\sec(\theta) = \frac{hyp}{adj} = \frac{\sqrt{73}}{8}$

3. [8 points] Evaluate the expressions below. Assume all angles are measured in radians.

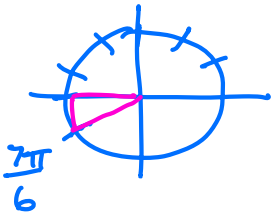
a. $\sin(4\pi/3) = -\frac{\sqrt{3}}{2}$



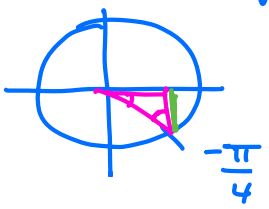
b. $\cos(\pi/2) = 0$



c. $\tan(7\pi/6) = \frac{-1/2}{-\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}}$



d. $\sin(-\pi/4) = -\frac{1}{\sqrt{2}}$



4. [4 points] An athlete is running along a straight path. The position of the athlete is given by $d(t) = \frac{1}{2}t^2 + t$, where t is time measured in seconds and d is distance measured in meters. Find the average velocity of the athlete between $t = 2$ and $t = 5$. Include units with your answer.

$d(2) = \frac{1}{2}(2)^2 + 2 = \frac{1}{2}(4) + 2 = 4$

$d(5) = \frac{1}{2}(5)^2 + 5 = \frac{1}{2}(25) + 5 = \frac{35}{2}$

$2\not{3}'5$
$-\ 8$
27

$$\text{average velocity} = \frac{\frac{35}{2} - 4}{5 - 2} = \frac{\frac{27}{2}}{3} = \frac{27}{6} \text{ meters/second}$$

$$= \frac{9}{2} \text{ meters/second}$$