Name: _____

Midterm One
Show all your work

Number: _____

Signature: _____

Score: ___/45

No Calculator allowed in this part.

Problem 1: Determine the following limits analytically showing all steps. Use the symbols DNE, ∞, and $-\infty$ where appropriate.

a. $\displaystyle\lim_{x\to-\infty} \frac{\sqrt{9x^2+5x}}{7x-6} =$

Score: /2

b. $\displaystyle\lim_{x\to 3} \frac{\sqrt{x+1}-2}{x-3} =$

Score: /2

c. $\displaystyle\lim_{t\to 2^-} \frac{|t-2|}{t^2-4} =$

Score: /2

Problem 2: Answer the following using derivative rules. Do NOT simplify.

a. Find the derivative of $h(x) = (x^3 - 2\sqrt{x} + 3\pi)^4 \csc(\sqrt[3]{x})$.

Score: /2

b. Find $d(g(x))/dx$ where
$$g(x) = \frac{\tan(x^2) - \log(5-3x)}{7^{3-x} + \sin(5x)}$$
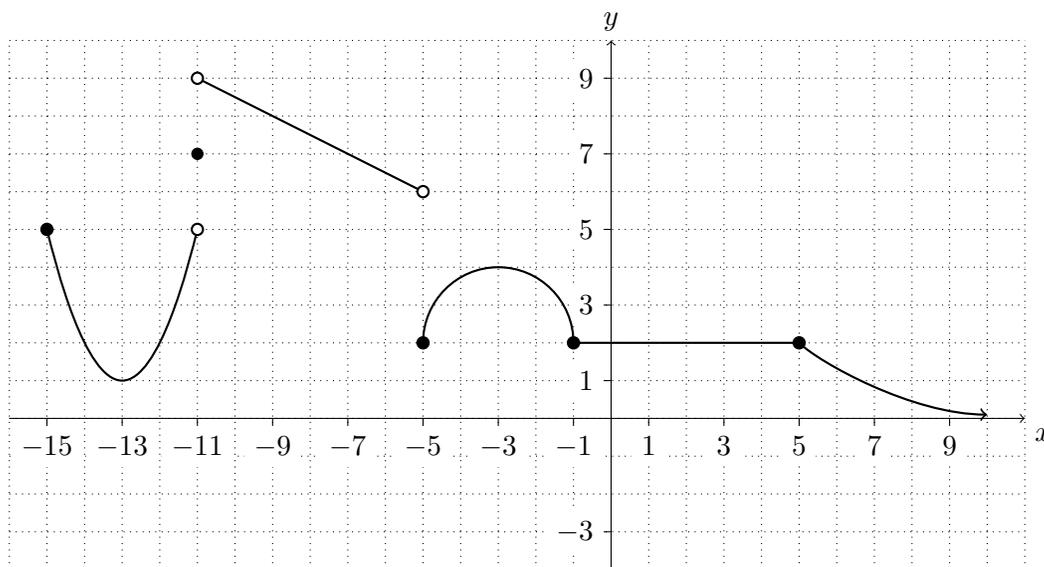
Score: /3

/11

Midterm One

Show all your work

Name: _____

Number: _____

Calculators allowed from here on.

Problem 3: The graph of $y = f(x)$ is shown, piece-wise defined by lines, a parabola, a semi-circle, and a decreasing reciprocal function. Use the graph to answer the questions. Use the symbols DNE, ∞, and $-\infty$ where appropriate.

a. In the domain of the function f on $[-15, \infty)$, list all x where f is discontinuous.

b. List the x value(s) where f is continuous but not differentiable.

c. $\lim\limits_{x \to -11^+} f(x) =$ _____

d. $\lim\limits_{x \to -11^-} f(x) =$ _____

e. $f(-11) =$ _____

f. $\lim\limits_{x \to -3} f'(x) =$ _____

g. $\lim\limits_{h \to 0} \dfrac{f(\pi + h) - f(\pi)}{h} =$ _____

h. $\lim\limits_{x \to -5^+} \dfrac{f(x) - f(-5)}{x + 5} =$ _____

i. In the same grid above, graph $y = f'(x)$ for the x-interval, $(-15, -1)$.

Score: ___/10

Problem 4: Use the limit definition of continuity to find a value c that makes the piece-wise defined function continuous everywhere. Draw your resulting function to check. From the graph, is the function differentiable at $x = 2$?

$$g(x) = \begin{cases} 6 - x, & x \le 2 \\ \sqrt{2x} - \dfrac{x}{2} + c, & x > 2 \end{cases}$$

Score: ___/4

___/14

Problem 5: Use correct notation, show all steps and leave your answer in simplified form.

a. Use the limit definition of the derivative to find the derivative of $f(x) = \sqrt{3x - 6}$.

b. Find an equation of the tangent line to f at $x = 5$.

Score: /5

Problem 6: The distance in metres of an object from a starting point after t seconds is given by $s(t) = 7 + \dfrac{3}{t + 1} + t^3$.

a. Find the average velocity of the object over the first 5 seconds.

Score: /2

b. Use a graphing calculator (TI83, TI83+, TI84-Plus) to set up a table of values to estimate the instantaneous velocity at 5 seconds. Round your answers to 2 decimal places. Specify your Y_1 and Y_2 as part of your steps.

Score: /3

$\boxed{/10}$

Problem 7: Show that the equation $x^2 - x - 1 = \dfrac{1}{1+x}$ has a solution in the interval $(1, 2)$ using the Intermediate Value Theorem.

Score: /4

Problem 8: Avocado seeds sprout faster in warmer temperatures. The following table shows groups of seeds and average sprouting time under each temperature.

Temperatures (°C):	20	18	23	25	31	27	33
Average number of Days to sprout:	42	55	40	25	15	20	11

Use the given data to answer the following questions:

    a. Draw a scatter plot. Provide dimensions of the window and label your axes according to the sample data.

Score: /4

    b. Use linear regression to find a model to fit your plot. Report your model to six decimal places.

Score: /1

    c. According to your model, what is the time needed for avocado seeds to sprout in 15° Celsius? Comment on the reliability of your answer.

Score: /1

/10