October 15, 2009 **Name** _____

The problems count as marked. The total number of points available is 163. Throughout this test, **show your work.**

1. (8 points) Find the exact value of the expression $|\pi - 7| + |2\pi - 10| + |3\pi - 8|$. Express your answer in a very simple form.

2. (8 points) Find an equation for a line perpendicular to the line $5x - 2y = 7$ and which goes through the point $(-3, 9)$. Express your answer in slope-intercept form.

3. (30 points) Evaluate each of the limits indicated below.

   (a) $\lim_{x\to\infty} \dfrac{3x^4 - 6}{(11 - 3x^2)^2}$

   (b) $\lim_{x\to 1} \dfrac{x^3 - 1}{x^2 - 1}$

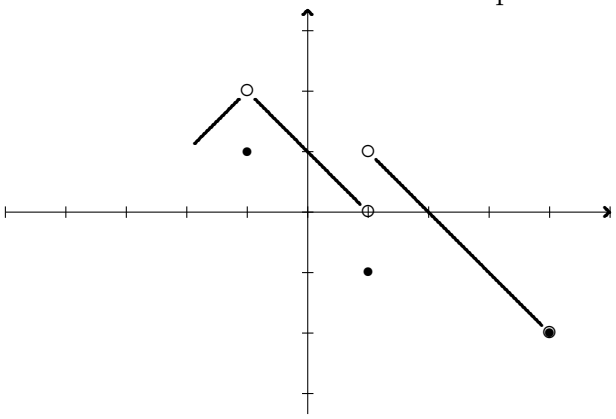
   (c) $\lim_{h\to 0} \dfrac{(2+h)^3 - 8}{h}$.

   (d) $\lim_{x\to 1} \dfrac{x^2 - 4x + 3}{x^2 + x - 2}$

   (e) $\lim_{x\to 3} \dfrac{\frac{4}{x} - \frac{4}{3}}{x - 3}$

   (f) $\lim_{x\to -\infty} \dfrac{\sqrt{36x^2 - 3}}{9x - 11}$

4. (18 points) Consider the function F whose graph is given below. Evaluate each of the following expressions. Note: Enter 'DNE' if the limit does not exist. The tick marks are one unit apart.



(a) $\lim_{x \to -1^-} F(x) =$

(b) $\lim_{x \to -1^+} F(x) =$

(c) $\lim_{x \to -1} F(x) =$

(d) $F(-1) =$

(e) $\lim_{x \to 1^-} F(x) =$

(f) $\lim_{x \to 1^+} F(x) =$

(g) $\lim_{x \to 1} F(x) =$

(h) $\lim_{x \to 3} F(x) =$

(i) $F(3) =$

5. (12 points) Find the domain of the function

$$g(x) = \frac{\sqrt{x+1}}{(x-1)(x-3)}.$$

Express your answer as a union of intervals. That is, use interval notation.

6. (12 points) The demand curve for a certain item is given by $p = x^2 - 15x + 98$ where x represents the quantity demanded in units of a thousand and p represents the price in dollars. The supply curve is given by $p = 4x + 50$. Find the equilibrium quantity and equilibrium price.

7. (10 points) Find all the x-intercepts of the function

$$g(x) = (2x^2 - 1)^2(3x + 1) - (2x^2 - 1)(3x + 1).$$

8. (30 points) Let $g(x) = \sqrt{\frac{(2x-15)(3x+17)}{x^2+x-6}}$. The sequence of steps below will enable you to find the (implied) domain of g. Let $r(x) = (g(x))^2 = \frac{(2x-15)(3x+17)}{x^2+x-6}$.

   (a) Find the zeros of r. That is, find all x for which $r(x) = 0$.

   (b) Find the value(s) of x for which r is undefined.

   (c) Write as a union of intervals the set of real numbers that result by removing the values of x found in the first two parts.

   (d) For each of the intervals in part (c), select a test point in the interval, and compute the sign (plus or minus) of r at that test point.

   (e) Express the domain of $g(x)$ as a union of intervals. Be sure to include or exclude the endpoints as appropriate.

9. (25 points) Let $f(x) = \sqrt{3x-2}$. Notice that $f(6) = \sqrt{18-2} = 4$.

   (a) Find the slope of the line joining the points $(6, 4)$ and $(6+h, f(6+h))$, where $h \neq 0$. Note that $(6+h, f(6+h))$ is a point on the graph of f.

   (b) Compute $f(a+h), f(a)$, and finally $\frac{f(a+h)-f(a)}{h}$.

   (c) Finally compute the limit as h approaches 0 to find $f'(a)$.

   (d) Replace the a with 6 to find $f'(6)$.

   (e) Use the information given and that found in (d) to find an equation for the line tangent to the graph of f at the point $(6, 4)$.

10. (10 points) Write in interval form the set of all real numbers x for which

$$f(x) = \frac{|\, x-1 \,|}{x-1} + \frac{|\, x+3 \,|}{x+3}$$

is continuous.