Name: Pre-Calculus
Date: Test #1

1) Solve $x^{\frac{1}{3}} - x^{\frac{1}{6}} = 12$

2) Graph, determine if the graph is a function and, if it is, rewrite the relation using function notation, find all relative maxima and minima, determine the domain and range, and identify the intervals where the graph is increasing or decreasing for the following piecewise relation

$$y = \begin{cases} x^2 + 8x + 11 & \text{for } x < -1 \\ -|x-1| + 4 & \text{for } -1 \le x < 4 \\ -3x + 15 & \text{for } x \ge 4 \end{cases}$$

3) Solve the inequality $\frac{4}{x^2 - 4} \ge \frac{3}{x^2 + 2x}$ and graph your final answer on a number line.

4) Find $(f-g)(x), (f \cdot g)(x)$, and $(f \circ g)(x)$ if $g(x) = 6x - 1$ and $f(x) = 2x^2 - 3x + 3$, evaluate $(f/g)(3k)$, and then construct and simplify $\frac{f(x+h) - f(x)}{h}$

5) Silas launches a model rocket with an initial velocity of 192 feet per second from a platform 5 feet off the ground. Find the equation for the flight path of the rocket where x stands for the time, in seconds, after launch and y stands for the height, in feet, of the rocket. Use completing the square to determine how many seconds after launch the rocket got to its maximum height AND determine the maximum height of the rocket.

6) Find the equations for all of the vertical, horizontal, and oblique asymptotes for the function $f(x) = \frac{2x^4 + 3x^3 - 9x^2 + 5x - 6}{x^3 - 10x^2 - 24x}$

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7) If the half-life of carbon-14 is 5730 years, how old is a bone that has lost 18% of its carbon-14? (round your answer to the nearest whole number)

8) Nina invests $84,053 in an account that earns 3.7% interest compounded continuously. If, when she closes the account, the bank gives her $108,901.91, how many years did Nina keep the money in the bank? (round your answer to the nearest whole number) If she had invested the same amount for the same amount of time and same interest rate but compounded quarterly, how much less money would you end up with compared to the continuous compounding?

9) Graph the equation $y = |x|$ and then use this graph to determine whether it is symmetric to the x axis, y axis, and/or the origin AND determine if it is even, odd, or neither even nor odd. Write an equation for a function that has a graph with the shape of $y = |x|$ but is shifted 4 units up, shifted 7 units to the left, is "fatter" by a factor of 3, and is upside down.

10) Use Descartes' rule of signs to determine the nature of the roots, then list all of the possible rational zeros, find all of the rational, irrational, or imaginary zeros if $f(x) = 0$, factor $f(x)$, and then use this information, along with your knowledge of end behavior, to make an approximate graph for the function if $f(x) = 3x^4 - 3x^3 + 21x^2 - 27x - 54$

Extra Credit

11) Solve: $\sqrt{2x-1} - \sqrt{x} = 2$

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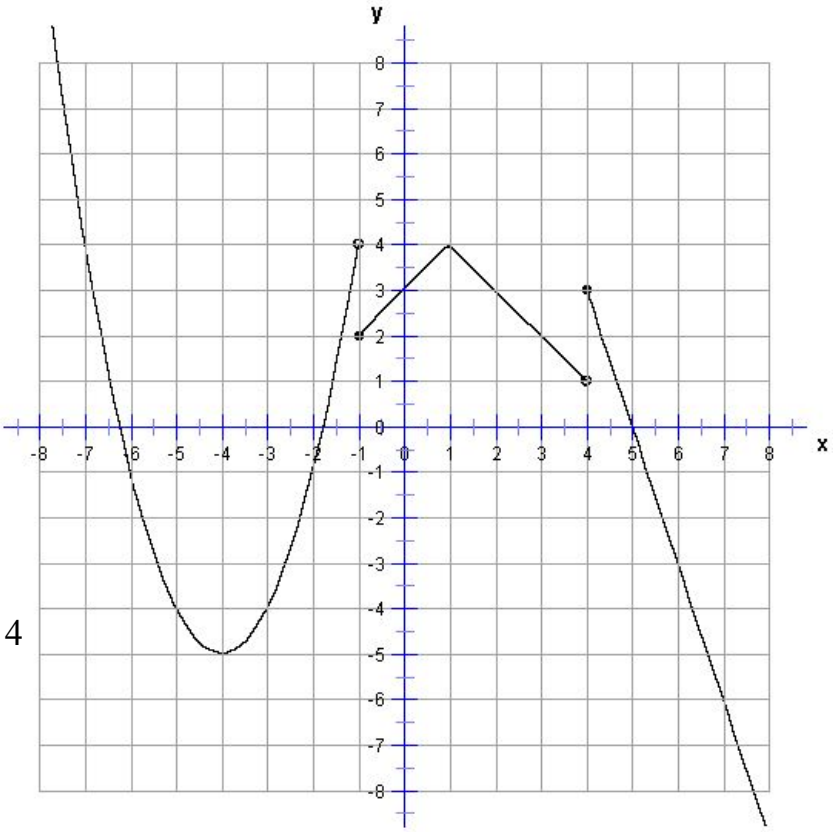
1) $x = 4,096$

2)



The relation is a function.

$$f(x) = \begin{cases} x^2 + 8x + 11 & \text{for } x < -1 \\ -|x-1| + 4 & \text{for } -1 \le x < 4 \\ -3x + 15 & \text{for } x \ge 4 \end{cases}$$

Relative Minima: $(-4,-5)$

Relative Maxima: $(1,4)$

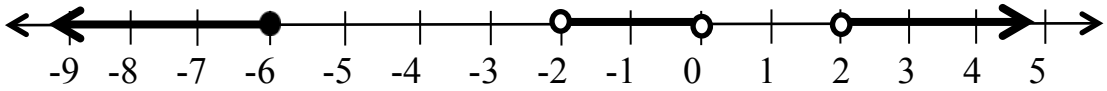
Domain: All Real Numbers or $\mathbb{R}$

Range: All Real Numbers or $\mathbb{R}$

Increasing: $-4 < x < 1$

Decreasing: $x < -4$ and $1 < x < 4$ and $x > 4$

3) $x > 2$ or $-2 < x < 0$ or $x \le -6$



4) $(f-g)(x) = 2x^2 - 9x + 4$ $(f \cdot g)(x) = 12x^3 - 20x^2 + 21x - 3$

$(f \circ g)(x) = 72x^2 - 42x + 8$ $(f / g)(3k) = \dfrac{18k^2 - 9k + 3}{18k - 1}$

$\dfrac{f(x+h) - f(x)}{h} = 4x + 2h - 3$

5) $y = -16x^2 + 192x + 5$ $y = -16(x-6)^2 + 581$ 6 seconds 581 feet

6) oblique asymptote: $y = 2x + 23$ vertical asymptotes: $x = 12, x = -2, x = 0$

7) 1,641 years old

8) 7 years $129.58

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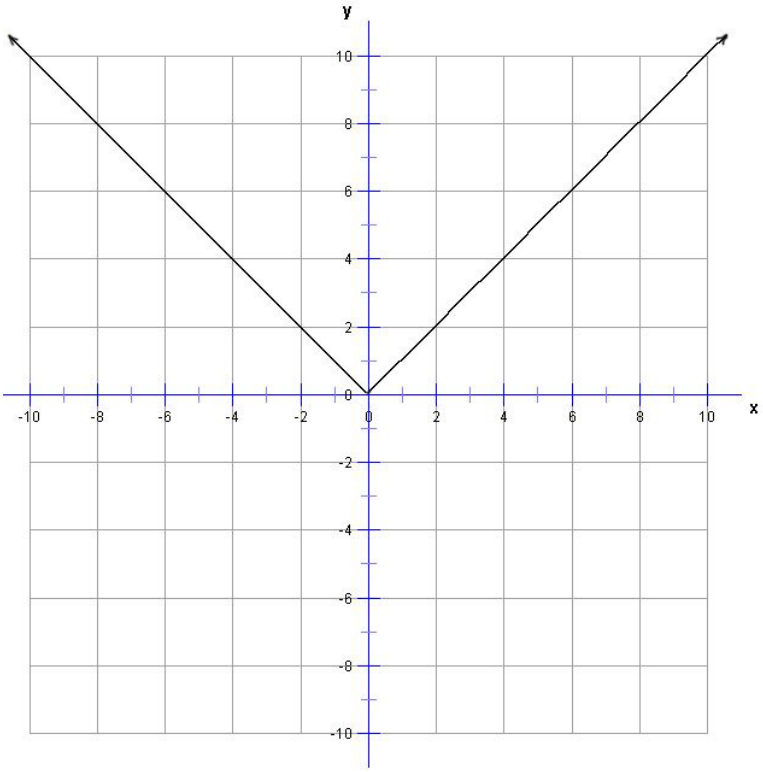
9) Symmetric to the y axis and it is even. $y = \dfrac{-|x+7|}{3} + 4$

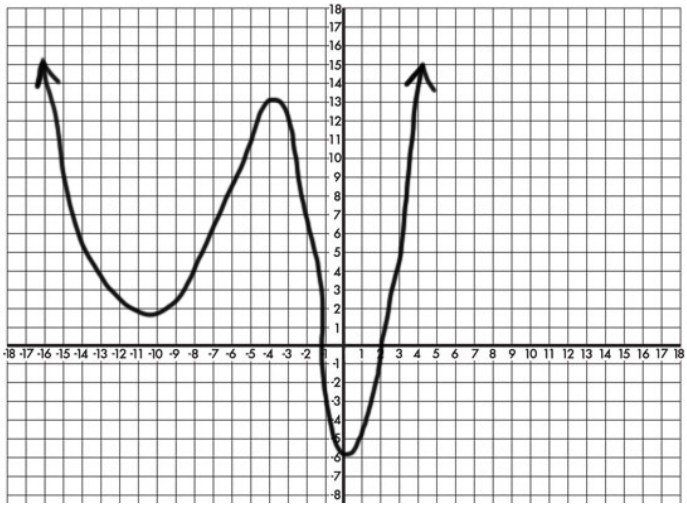


10)

Positive Real Roots	Negative Real Roots	Imaginary Roots
3	1	0
1	1	2

$\pm 1, 2, 3, 6, 9, 18, 2$

zeros $= -1, 2, 3i, -3i$ $\quad f(x) = (x+1)(x-2)(x-3i)(x+3i)$



Extra Credit

11) $x = 25$