MSLC – Math 1150
Exam 1 Review

Disclaimer: This should NOT be used as your only guide for what to study.

1. Use the piece-wise defined function $f(x)=\begin{cases} x^2+2 & \text{if } x\le 0 \\ -2x+4 & \text{if } x\ge 3 \end{cases}$ to answer the following:
   a) Compute *f*(0), *f*(3), *f*(-1), and *f*(4).
   b) Plot the points you found above and sketch a complete graph of $y = f(x)$.

2. Determine whether or not each equation is a function of *x*.
   a) $y=x^2-3x+4$
   b) $x^2+y^2=1$
   c) $x^2+y^3=4$
   d) $xy=1$

3. Use your graphing calculator to graph each of the functions below over the interval $(-2,2)$ and approximate any local extrema. Also, determine the intervals where the functions are increasing and decreasing.
   Round your answers to three decimal places where appropriate.
   a) $f(x)=x^2$
   b) $g(x)=(x-1)^2(x+1)^2$
   c) $h(x)=\sqrt{|x|}$
   d) $k(x)=x(x-1)(x+1)$

4. Determine the average rate of change of the functions between the given values of *x*.
   a) $f(x)=\dfrac{x}{3x+1}$ from $x=1$ to $x=t$
   b) $g(x)=\dfrac{1}{\sqrt{x+1}}$ from $x=0$ to $x=a$

5. Write the equation of the function $f(x)=|x|$ transformed in the following ways:
   a) shifted 2 units to the left, and shifted up 3 units
   b) reflected about the *x*-axis, then shifted down 3 units
   c) shifted 1 unit to the right, and vertically stretched by a factor of 3
   d) shifted 1 unit to the left, then reflected about the *y*-axis

6. Given $f(x)=\sqrt{x+1}$ and $g(x)=\dfrac{1}{2x+1}$ find:
   a) $f \circ g$
   b) $g \circ f$
   c) $f \circ f$
   d) $g \circ g$

7. Find the inverse of each function, state the domain and range of both the original function and its inverse.
   a) $f(x)=2x-1$
   b) $g(x)=x^3+1$
   c) $k(x)=\dfrac{1}{x-3}$

8. Algebraically find the maxima and minima of the functions given.
   a) $f(x)=3x(x-2)+5$
   b) $g(x)=-\dfrac{x^2}{5}+\dfrac{x}{3}-7$

9. For each of the following polynomial functions:
   i. Find each real zero and its multiplicity.
   ii. Determine whether the graph crosses or touches the x-axis at each zero.
   iii. Find the power function that each function resembles for large values of $|x|$.
   iv. Graph each function using your graphing calculator.
   a) $f(x)=4(x-2)(x+1)^2$
   b) $g(x)=(x^2+1)(x+1)^2$
   c) $h(x)=-x^2(x-2)(x+3)^5$

10. Divide:
   a) $(2x^3-x^2+3)\div(x+2)$
   b) $(x^4-1)\div(x^2+1)$

11. Factor the polynomials into linear and irreducible quadratic factors with real coefficients.
   a) $P(x)=x^4-2x^3-2x^2-2x-3$
   b) $Q(x)=x^4-x^2+2x+2$

12. Factor the polynomials into linear factors with complex coefficients.
    a) $P(x) = x^4 - 2x^3 - 2x^2 - 2x - 3$
    b) $Q(x) = x^4 - x^2 + 2x + 2$

13. Find all asymptotes and any intercepts, then sketch the graph of the function:

    a) $R(x) = \dfrac{x}{(x-1)(x+1)}$

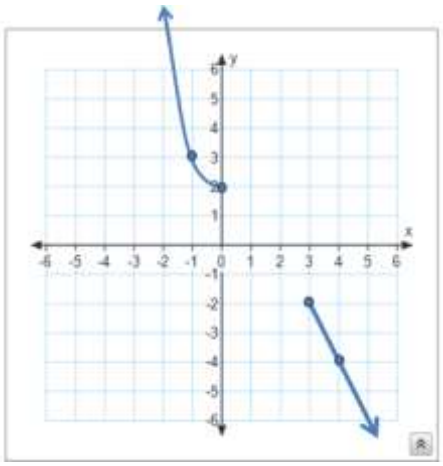
    b) $R(x) = \dfrac{x^2+2}{x-2}$

    c) $R(x) = \dfrac{x^2-4x}{x^2-2x+1}$

    d) $R(x) = \dfrac{2x^2-8x+6}{x^2-3x+2}$

Exam 1 Review Solutions

1. a) $f(0) = 2$; $f(3) = -2$;
   $f(-1) = 3$; $f(4) = -4$
   b)



2. a) Function b) Not a function c) Function d) Function

3. a) Min: $(0,0)$; Increasing: $(0,2)$; Decreasing: $(-2,0)$

   b) Mins: $(-1,0)$ & $(1,0)$; Max: $(0,1)$

   Increasing: $(-1,0)\cup(1,2)$; Decreasing: $(-2,-1)\cup(0,1)$

   c) Min: (0,0); Increasing: $(0,2)$; Decreasing: $(-2,0)$

   d) Min: $(0.578,-0.385)$; Max: $(-0.578,0.385)$;

   Increasing: $(-2,-0.578)\cup(0.578,2)$; Decreasing: $(-0.578,0.578)$

4. a) $\dfrac{1}{12t+4}$ b) $\dfrac{1-\sqrt{a+1}}{a\sqrt{a+1}}$

5. a) $y=|x+2|+3$ b) $y=-|x|-3$ c) $y=3|x-1|$ d) $y=|-(x-1)|$

6. a) $(f\circ g)(x)=\sqrt{\dfrac{2x+2}{2x+1}}$ b) $(g\circ f)(x)=\dfrac{1}{2\sqrt{x+1}+1}$

   c) $(g\circ g)(x)=\dfrac{2x+1}{2x+3}$ d) $(f\circ f)(x)=\sqrt{\sqrt{x+1}+1}$

7. a) $f^{-1}(x)=\dfrac{x+1}{2}$ Domain $f(x)=(-\infty,\infty)$; Range $f(x)=(-\infty,\infty)$

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   b) $g^{-1}(x)=\sqrt[3]{x-1}$ Domain $g(x)=(-\infty,\infty)$; Range $g(x)=(-\infty,\infty)$

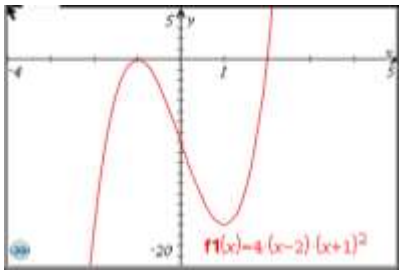
   Domain $g^{-1}(x)=(-\infty,\infty)$; Range $g^{-1}(x)=(-\infty,\infty)$

   c) $k^{-1}(x)=\dfrac{1}{x}+3$ Domain $k(x)=(-\infty,3)\cup(3,\infty)$; Range $k(x)=(-\infty,0)\cup(0,\infty)$

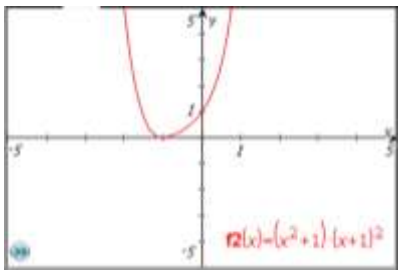
   Domain $k^{-1}(x)=(-\infty,0)\cup(0,\infty)$; Range $k^{-1}(x)=(-\infty,3)\cup(3,\infty)$

8. a) Min.: $(1,2)$ b) Max.: $\left(\dfrac{5}{6},-\dfrac{247}{36}\right)$

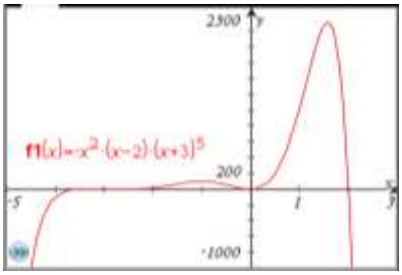
9. a) Zero: 2 (multiplicity 1) [crosses]; Zero: -1 (multiplicity 2) [touches]
Power function: $p(x) = 4x^3$



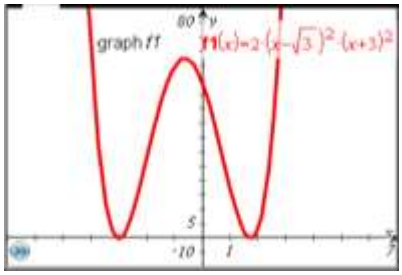
b) Zero: -1 (multiplicity 2) [touches]; Power function: $p(x) = x^4$



c) Zero: 0 (multiplicity 2) [touches]; Zero: 2 (multiplicity 1) [crosses];
Zero: -3 (multiplicity 5) [crosses]; Power function: $p(x) = -x^8$;



d) Zero: $\sqrt{3}$ (multiplicity 2) [touches]; Zero: -3 (multiplicity 2) [touches];
Power function: $p(x) = 2x^4$

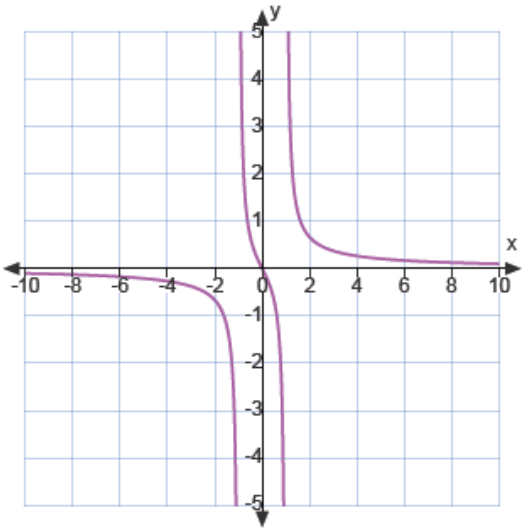


10. a) $2x^2-5x+10-\dfrac{17}{x+2}$ b) x^2-1

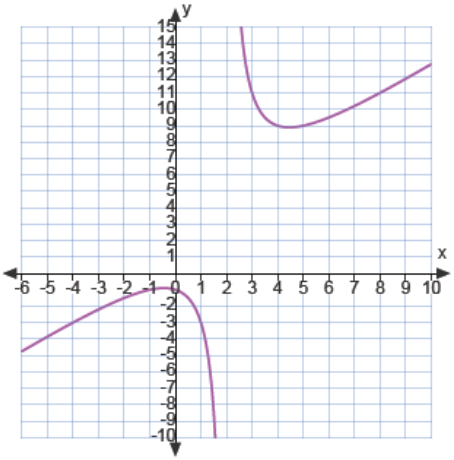
11. a) $(x+1)(x-3)(x^2+1)$ b) $(x+1)^2(x^2-2x+2)$

12. a) $(x+1)(x-3)(x+i)(x-i)$ b) $(x+1)^2[x-(1-i)][x-(1+i)]$

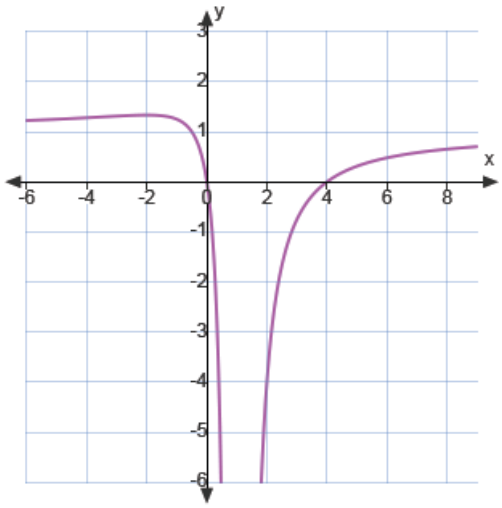
13. a) Intercept: (0,0); Vertical Asymptotes: $x=-1$ and $x=1$ Horizontal Asymptote: $y=0$



b) Intercept: (0, -1); Vertical Asymptote: $x=2$; Slant Asymptote: $y=x+2$



c) Intercepts: (0,0) and (4, 0); Vertical Asymptote: $x = 1$ Horizontal Asymptote: $y = 1$



d) Intercepts: (3,0) and $(0,3)$; Vertical Asymptote: $x = 2$ Horizontal Asymptote: $y = 2$