

Please print this assignment single-sided and write your solutions neatly in the provided white-space (if you write solutions on your own paper and do not print this there is a 30pt penalty). Box your answers for full credit and show work. Use interval notation to express solution set for inequality questions. At least 100pts to earn here. Thanks!

Problem 33: Add, subtract, multiply or divide and simplify the expression into lowest terms:

(a.) $\frac{x}{3} + \frac{x-1}{2} + 3$

(b.) $\frac{3}{x} - \frac{x+1}{x^2}$

(c.) $\frac{x}{x+3} - \frac{x+1}{x+2}$

(d.) $\frac{x^2-1}{x+3} \cdot \frac{x^2-9}{x^2+2x+1}$

(e.) $\frac{1 + \frac{1}{x+1}}{2 + \frac{1}{x+1}}$

$$(f.) \frac{x}{x+3} - \frac{3x}{x^2+6x+9}$$

$$(g.) (x^2+3x+2) \left(\frac{1}{x+1} - \frac{1}{x+2} \right)$$

Problem 34: Solve $\frac{x}{x-3} = 4$.

Problem 35: Solve $\frac{x+2}{x+3} = \frac{4}{x}$.

Problem 36: Solve $\frac{4}{x} - \frac{3}{x^2} = 1$.

Problem 37: Solve $\frac{x - 11}{x + 3} \leq 2$.

Problem 38: Solve $\frac{(x + 3)(x - 4)}{(x - 2)(x - 6)} \geq 0$.

Problem 39: Solve $\frac{(x + 3)^2(x + 1)}{(x^2 - 9)x^3} \leq 0$.

Problem 40: Solve $\frac{x^2 + 4x + 5}{x^2 - 13x + 42} \geq 0$.

Problem 41: Solve $\frac{x}{x+3} \geq \frac{2}{x+2}$.

Problem 42: Given $x, y > 0$, find values of C , A and B for which:

(a.) $Cx^Ay^B = \frac{\sqrt{25xy^3}}{\sqrt[3]{8x^2y^5}}$

(b.) $Cx^Ay^B = \frac{39x\sqrt{y}}{13x^2\sqrt[3]{y}}$

(c.) $Cx^Ay^B = \frac{1}{x} \cdot (x^2\sqrt{y}) \cdot \frac{y^{3/2}}{x}$

Problem 43: Solve $x + \sqrt{x - 3} = 5$

Problem 44: Solve $\sqrt{x + 1} + \sqrt{x - 4} = 5$

Problem 45: Solve $\frac{\sqrt{x + 2}}{\sqrt{4x + 1}} = \frac{2}{3}$

Problem 46: Solve $x = \sqrt[3]{3x^2 - 2x}$

Problem 47: Solve $\frac{x}{\sqrt[3]{x}} = \pi$ (leave answer in terms of π)

Problem 48: Solve $\frac{1}{x} - \frac{3}{\sqrt{x}} + 2 = 0$

Problem 49: For each formula, sketch the graph of $y = f(x)$ and find the domain and range:

(a.) $f(x) = \sqrt{3 - x}$

(b.) $f(x) = \frac{1}{x - 2}$

(c.) $f(x) = 1 + \frac{1}{x^2}$

(d.) $f(x) = 3 + 2(x - 2)^2$

(e.) $f(x) = \sqrt[3]{x - 1}$

(f.) $f(x) = 2 - |x - 3|$

Problem 50: Let $f(x) = \begin{cases} x^2 + 3 & \text{if } x < 1 \\ x^3 & \text{if } x \geq 1 \end{cases}$. Graph $y = f(x)$ and evaluate $f(2)$ and $f(0)$. What is the range of f ?

Problem 51: Rewrite the formula for $f(x) = \frac{x-1}{\sqrt{(x-1)^2}}$ as a casewise-defined function. Also, find the domain and range of the function.

Problem 52: Determine if the equations below define y as a single function of x by solving the equations below for y :

(a.) $x^2 + (y-1)^2 = 4$

(b.) $y^3 + 2x^2 - 1 = 0$

(c.) $\frac{3x - y}{2y - x} = 1$

Problem 53: Equations are generally much more exotic than we can reasonably test in-class in Math 121. Let's use computer graphing system to explore a bit. For each formula below, sketch the graph you see in Desmos and determine if the equation defines a function in view of the vertical line test:

(a.) $2x^2 + xy + 2y^2 = 7$

(b.) $(x^2 + y^2 - 9)(x^8 - y^4) = 0$

Problem 54: Determine the domain of the functions given below:

(a.) $f(x) = \frac{1}{\sqrt{x^2 + 6x + 20}}$

(b.) $f(x) = \sqrt{9 - x^2}$

Problem 55: Suppose f and g are functions for which $f(1) = 13$ and $g(1) = 3$ whereas $f(-2) = 7$ and $g(13) = 8$. Given this data, calculate the following:

(a.) $(gf)(1)$

(b.) $(f + g)(1)$

(c.) $(3f)(-2)$

(d.) $(g \circ f)(1)$

Problem 56: Suppose $f(x) = 3x + 1$ and $g(x) = 1 + \frac{1}{x^2}$. Find the (unsimplified) formulas for:

(a.) $(fg)(x)$

(b.) $(f - g)(x)$

(c.) $(f \circ g)(x)$

(d.) $(g \circ f)(x)$

Problem 57: Solve $K = \frac{1}{2}mv^2$ for v .

Problem 58: Suppose $U = \frac{-Gm_1m_2}{R+h}$. Solve for h .

Problem 59: Let $f(x) = 5x^5 + 4x^4 + 3x^3 + 2x^2 + 1$ and $g(x) = x^3 + 2x - 3$. Use polynomial long division to find $p(x)$ and $r(x)$ for which $\frac{f(x)}{g(x)} = p(x) + \frac{r(x)}{g(x)}$ where $\deg(r(x)) < \deg(g(x))$:

Problem 60: Let $f(x) = x^4 - 10x^3 + 35x^2 - 50x + 24$. Factor $f(x)$ completely over \mathbb{R} . Thou shall begin by dividing $f(x)$ by $x^2 - 3x + 2$ via polynomial long division.

Problem 61: Let $f(x) = x^5 - 4x^4 + 5x^3 - 8x^2 + 32x - 40$. Factor $f(x)$ completely over \mathbb{R} . Hint: $f(2 + i) = 0$ so you know a particular quadratic polynomial factors $f(x)$.

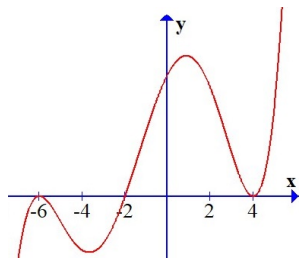
Problem 62: Let $f(x) = x^4 - 6x^3 + 14x^2 - 21x + 35$.

- (a) Use long-division to divide $f(x)$ by $g(x) = x^2 - 6x + 10$, is $g(x)$ a factor of $f(x)$?
- (b) Calculate the value of $f(3 + i)$

Problem 63: Find the formula for the real polynomial $f(x)$ of least degree which has $f(2i) = 0$, $f(-3) = 0$ and $f(1) = 40$.

Problem 64: Find the formula for the real polynomial $f(x)$ of least degree which has a factor $(x + 2)$ with multiplicity 3 and $f(-1) = 0$ given that $f(3) = 200$.

Problem 65: Given $f(0) = 32$, find the polynomial $f(x)$ of least degree with the graph below:



Problem 66: Consider $f(x) = x^4 + x^3 - 13x^2 - x + 12$. Evaluate $f(1)$ and $f(-1)$ and factor $f(x)$ completely over \mathbb{R} .

Problem 67: Sketch the graph of $y = (2x - 20)(2x - 1)(x + 4)^2(x - 5)^2$.

Problem 68: Consider $f(x) = \frac{x-2}{x+3}$. Sketch the graph $y = f(x)$ and label any x -intercepts, vertical asymptotes, horizontal asymptotes, and any holes in the graph.

Problem 69: Consider $f(x) = \frac{x}{x^2-9}$. Sketch the graph $y = f(x)$ and label any x -intercepts, vertical asymptotes, horizontal asymptotes, and any holes in the graph.

Problem 70: Consider $f(x) = \frac{x+4}{x^2-16}$. Sketch the graph $y = f(x)$ and label any x -intercepts, vertical asymptotes, horizontal asymptotes, and any holes in the graph.

Problem 71: Consider $f(x) = \frac{x^2-6x+9}{2x^2-3x-9}$. Sketch the graph $y = f(x)$ and label any x -intercepts, vertical asymptotes, horizontal asymptotes, and any holes in the graph.

Problem 72: Consider $f(x) = \frac{12}{x+4} - \frac{3}{x-3} - 2$. Sketch the graph $y = f(x)$ and label any x -intercepts, vertical asymptotes, horizontal asymptotes, and any holes in the graph.