MATH 116 **NAME:**
PRECALCULUS **ID#:**

TAKE-HOME EXAM 1

Solve the following problems showing all your work for full credit.

1. Use the universal set $U = \{a, b, c, d, e, f\}$, $A = \{a, b, e, f\}$, and $B = \{b, c, d, e\}$ to find each set:

a) (1 pt.) $A \cap B$

b) (1 pt.) $A \cup B$

c) (1 pt.) $\overline{B}$

2. (4 pts.) Let $P(x) = 3x^3 - x^2 + x - 2$ and $D(x) = x - 2$. Use long division to find the quotient $Q(x)$ and the remainder $R(x)$ such that $P(x) = D(x).Q(x) + R(x)$.

3. Factor each polynomial completely.

a) (1 pt.) $x^2 - 100$

b) (2 pts.) $x^2 + 6x - 16$

c) (3 pts.) $7x^3 - 7x$

d) (3 pts.) $x^4 - x^3 + x - 1$

4. Simplify each expression. Assume that all variables represent positive numbers.

a) (2 pts.) $\dfrac{x^2-5x+6}{x^2+x-12}$

b) (3 pts.) $\dfrac{1-x}{x}+\dfrac{3-x}{x-2}$

c) (3 pts.) $\dfrac{x^2-4x+4}{x^3+4x}\cdot\dfrac{3x^2+12}{x^2-x-2}$

5. Find all solutions of each equation.

a) (3 pts.) $3+2|3x-1|=9$

b) (4 pts.) $\dfrac{1}{x-1}+\dfrac{1}{x+2}=\dfrac{5}{4}$

c) (3 pts.) $(x-2)(x+1)=3$

d) (3 pts.) $\sqrt[3]{2x+1}=-2$

e) (3 pts.) $\sqrt{15-2x}=x$

6. Solve each inequality. State the solution set using interval notation.

a) (2 pts.) $4-5x \geq -6$

b) (3 pts.) $2|x-1|+5 > 7$

c) (3 pts.) $|2x-1| \leq 5$

d) (3 pts.) $-6 \leq 2x-4 < 5$

7. Rationalize the denominator of each expression:

a) (1 pt.) $-\dfrac{\sqrt{3}}{\sqrt{7}}$

b) (3 pts.) $\dfrac{\sqrt{2}}{\sqrt{5}+2}$

8. Write an equation of the line

a) (2 pts.) containing the points (2, 5) and (-1, 11)

b) (3 pts.) containing the point (3, -2) and parallel to the line $3x - y = 1$

c) (3 pts.) containing the point (3, -2) and perpendicular to the line $-x + 2y = 2$

9. Find the domain of each function using interval notation.

a) (2 pts.) $f(x) = \dfrac{3}{x^2 - 4x + 3}$

b) (2 pts.) $P(x) = \dfrac{6}{\sqrt{2x - 4}}$

c) (3 pts.) $g(t) = \dfrac{\sqrt{t+3}}{t-5}$

10. (5 pts.) Let $f(x) = 3x^2 - 2x + 1$. Find and simplify completely the difference quotient $\dfrac{f(x+h) - f(x)}{h}$

11. Determine algebraically whether each function is even, odd or neither even nor odd.

a) (2 pts.) $f(x) = 2x^4 - 5x^2$

b) (2 pts.) $g(x) = \dfrac{2x}{x^2 - 1}$

c) (2 pts.) $h(t) = t^3 + 5$

12. Let $f(x) = \dfrac{2x-6}{x-2}$

a) (2 pts.) Is the point $(\frac{1}{2}, \frac{10}{3})$ on the graph of $f(x)$?

b) (2 pts.) If $x = 6$, what is $f(x)$? What point is on the graph of $f(x)$?

c) (3 pts.) If $f(x) = 1$, what is x? What points are on the graph of $f(x)$?

d) (2 pts.) What is the domain of $f(x)$?

e) (2 pts.) List the x-intercepts, if any, of the graph of $f(x)$.

f) (3 pts.) List the y-intercept, if there is one, of the graph of $f(x)$.

13. (5 pts.) Sketch the graph of the piecewise-defined function $f(x)$

$$f(x) = \begin{cases} 3 & , \quad x \le -3 \\ 2x+4 & , \quad -2 \le x < 1 \\ 4-x & , \quad 1 \le x \end{cases}.$$

Label all x- and y- intercepts and all special points.