

Name: \_\_\_\_\_

1. Read each question carefully.
2. Please write legibly.
3. TO ENSURE FULL CREDIT, EXPLAIN YOUR WORK FULLY.
4. This exam has **6** pages.
5. The total number of points on this exam is 50.
6. Books and notes are not allowed in this exam.
7. Independent work is expected.

1. (1') List all possible rational zeros of the function  $f(x) = 2x^4 - 3x^3 - x + 8$ .

Answer \_\_\_\_\_

2. Consider the function  $f(x) = -x^2 + 7x - 6$

(2') (i). Find the vertex, the axis of symmetry,

The vertex \_\_\_\_\_ ; the axis \_\_\_\_\_

(2') (ii) Find the x-, y-intercepts

The x-intercepts \_\_\_\_\_ ; the y-intercept \_\_\_\_\_

(2') (iii) Sketch the graph of  $f(x)$

(1') (iv). Determine any maxima or minima of the function and find the value.

Answer \_\_\_\_\_

(1') (v). Determine where the function is increasing and where it is decreasing.

$f(x)$  is increasing on \_\_\_\_\_ ;  $f(x)$  is decreasing on \_\_\_\_\_

(4') 3. Use synthetic division to find the quotient and the remainder. (No credits for other methods)

$$(3x^3 - x^2 + 4x - 10) \div (x + 1)$$

Quotient \_\_\_\_\_ and the remainder \_\_\_\_\_

(4') 4. Find the inverse function  $f^{-1}(x)$  of the one-to-one function  $f(x) = \frac{x+4}{x-3}$ .

$$f^{-1}(x) = \underline{\hspace{2cm}}$$

(4') 5. Graph both functions using the same set of axes  $f(x) = e^x$ ,  $g(x) = \left(\frac{1}{1.5}\right)^x$  (Donot forget to label x-, y-intercepts if they exist).

(3') 6. Find a polynomial function of degree 4 with rational coefficients that has zeros: 0,  $-5$  and  $3i$ .

7. Consider  $f(x) = -\frac{1}{2}(x - 2)(x + 1)^2(x - 1)$

(2') (1) Find the zeros and state the multiplicity of each zeros for  $f(x)$

Zeros \_\_\_\_\_ and the corresponding multiplicity \_\_\_\_\_

(1') (2) Determine the x-, y-intercepts

The x-intercepts \_\_\_\_\_ ; the y-intercept \_\_\_\_\_

(4') (3) Sketch the graph of  $f(x)$  (Label all  $x$  and  $y$  intercepts)

8. Consider  $f(x) = \frac{x-1}{x^2-2x-3}$ .

(1') (i) Determine the domain of  $f(x)$ .

The domain: \_\_\_\_\_

(3') (i). Determine the vertical and horizontal asymptotes of the graph of  $f(x)$

Vertical asymptotes: \_\_\_\_\_ and horizontal asymptotes: \_\_\_\_\_

(1') (ii) Determine the x-, y-intercepts

The x-intercepts \_\_\_\_\_ ; the y-intercept \_\_\_\_\_

(4') (iii) Sketch the graph of  $f(x)$  **together with** its all asymptotes (and x-,y-intercepts).

9. Solve the following inequalities or equalities.

$$(3') (1) \frac{x-1}{x+2} < 0$$

$$(3') (2) 2 + \sqrt{x+4} = x$$

$$(2') (3) x - 3\sqrt{x} - 4 = 0$$

$$(2') (4) \left| \frac{2x-1}{3} \right| \geq \frac{5}{6}$$