Math 120: Final Examination

Fall 2012   **Total= 70. Time= 2 hours.**

Instructions:

1. Cell phones and any other electronic devices **must be put off and not within your reach**.

2. Students are expected to respect the Academic Code of Honor.

3. All work must be shown. Answers with no justification are not acceptable.

4. Your work must clearly show the question number and section, for example, 1a.

5. Number your answer sheets, that is, 1 of 3, 2 of 3, etc.

6. Calculators are **not** allowed.

7. Students will not be allowed to enter after the first 30 minutes of the exam or leave in the first 30 minutes of the exam.

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1. Answer true or false giving justification.   (3)

    (a) $f(x) = x^2 - x + 1$ is a one to one function.

    (b) $f(x) = x^2 - x^4 + 1$ is an even function.

    (c) The graph of $y = \dfrac{3x^3 + x^2}{x + 1}$ has a slant asymptote.

2. Find the equation of the line passing through $(1,1)$ and parallel to $3x + 4y + 2 = 0$.   (3)

3. Find the x and y intercepts and sketch the following graphs using transformations. Show clearly the base graph and the transformations made on it.   (6)

See back side of sheet for remaining questions

(a) $y = -\ln(x+1) + 2$.

(b) $y = 3(\frac{1}{3})^{x-1} - 1$.

4. Let $f(x) = \log(x)$, $g(x) = 2x - 1$ and $h(x) = \dfrac{1}{\sqrt{x-1}}$. (9)

(a) Find $g \cdot h(x)$ and its domain.

(b) Find $\dfrac{f}{g}$ and its domain.

(c) Find the composition $hog(x)$ and its domain.

5. Find the zeroes and their multiplicities of $f(x) = (x-1)^2(x+1)(x-3)$ and sketch the graph of $y = f(x)$. (3)

6. Let $f(x) = 2x^5 - 3x^4 - x^3 - x^2 - 3x + 2$. (8)

(a) Show that $\frac{1}{2}$ is a zero of $f(x)$ and write down the corresponding factorization.

(b) Write down the list of all rational zeroes of $f(x)$.

(c) Find all the real zeroes of $f(x)$ and write down the corresponding factorization.

7. Let $f(x) = \dfrac{x^2 + x}{(x-1)(x+2)}$. (12)

(a) Find all the horizontal and vertical asymptotes and the x and y intercepts of the graph $y = f(x)$.

(b) Write down the behaviour of the graph close to each vertical asymptote and also give the end behaviour.

(c) Sketch the graph of $y = f(x)$.

(d) Find the domain and the intervals where $f(x) > 0$.

8. Find $f^{-1}(x)$ if $f(x) = \dfrac{2x+3}{x-1}$. Write down the domains and ranges of both functions. (3)

9. Solve the following. (11)

(a) $9x \le x^2$.

(b) $\log(x-2) + \log(x+3) = \log(2x)$.

2

(c) $2^{3x+1} = 3^{5x}$.

10. Find the exact values (no logs in the answer) in the following.   (8)

    (a) $\log_2(\frac{1}{8})$.

    (b) $e^{3\ln(2)}$.

    (c) $\log_2(\frac{10}{3}) - \log_2(\frac{5}{3})$.

    (d) $\log_2(2\log_4(2))$.

11. A rectangular playground has to be fenced off and divided in two by another fence parallel to one side of the playground. Six hundred feet of fencing is used. Find the dimensions of the playground that maximize the total area enclosed. What is the maximum area?   (4)