MATH1106: Precalculus – Fall 2010 – Test 1

Part I: Multiple Choice Questions

1. The graph of the equation $2x^3y - x = x^3y^4$ is symmetric about the
(A) x-axis **(B)** y-axis **(C)** the origin **(D)** None

2. What is the domain for $g(x) = \dfrac{\sqrt{3+x}}{2-x}$?
(A) $[-3, 0) \cup (0, \infty)$ **(B)** $[-3, 2) \cup (2, \infty)$ **(C)** $(-3, \infty)$ **(D)** $[-3, \infty)$ **(E)** None of these

3. Which of the following lines is parallel to $y = 3x - 2$?
(A) $2x + 6y + 1 = 0$ **(B)** $3x + y - 5 = 0$ **(C)** $-6x + 2y + 5 = 0$ **(D)** $-x + 3y + 4 = 0$ **(E)** None of these

4. Which of the following equations has one real solution only?
(A) $x^2 + 4x - 2 = 0$ **(B)** $4x^2 + 3x + 2 = 0$ **(C)** $4x^2 + 12x + 9 = 0$ **(D)** $|x - 1| = 3$ **(E)** None of these

5. Which of the following functions is even?
(A) $f(x) = \dfrac{1}{3x^2 + x}$ **(B)** $f(x) = 3x^2 + |x - 2|$ **(C)** $f(x) = 3x^2 + |x| - 2$ **(D)** $f(x) = |x + 2|$

6. If $f(x) = 5x - 2$, find $f^{-1}(13)$
(A) -2 **(B)** 3 **(C)** -5 **(D)** 5 **(E)** None of these

Part II: Short Answer Questions

- This part is worth 38 marks out of 50. Simplify your answer when possible.
- To get full marks you have to show all necessary work.
- Write your answer in the space provided after the question.

1. (**7 marks**) Find all real solutions of the equation $x + \sqrt{14 - 2x} = 3$.

2. (**6 marks**) Solve the inequality $\dfrac{1}{x+3} \geq \dfrac{x-2}{(x+1)^2}$ and write your answer in interval form.

3. (**7 marks**) Talal drove from Sur to Ibri, a distance of 420 km. On the way back he increased his speed by 10 km/h. The total trip took 13 hours of driving time. Find his speed from Sur to Ibri.

4. (**5 marks**) Let $f(x) = \dfrac{1}{3}x^2 - 3x - 2$.

(a) Write f in standard form.

(b) What is the minimum value of f?

(c) Find the range of f. Write your answer in interval form.

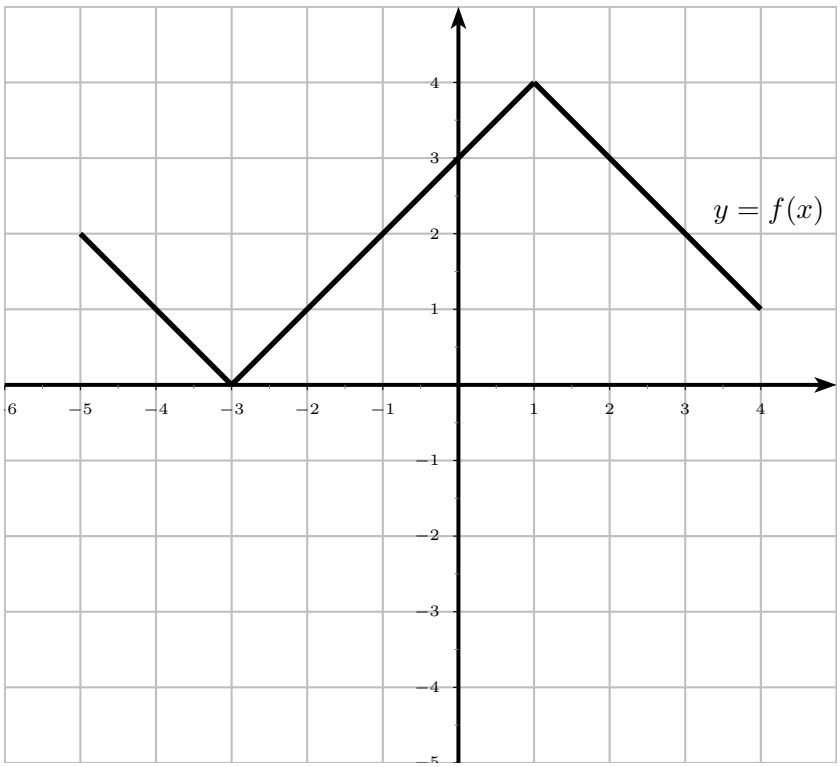
5. (**6 marks**) Let $f(x) = \dfrac{1}{x^2 - 4}$ and $g(x) = \sqrt{x+3}$. Find $f \circ g$ and its domain. Write your answer in interval form.

6. **(7 marks)** The graph of a function $y = f(x)$ is given on $[-5, 4]$. Let $g(x) = 2 - f(x+1)$.

(a) **(1 mark)** Evaluate $g(3)$.

(b) **(3 marks)** Explain in words how the graph of g is obtained from the graph of f.

(c) **(3 marks)** Sketch the graph of $y = g(x)$. **Show only the final graph** on the same coordinate system provided below and clearly label all x and y intercepts.



MATH1106: Precalculus – Fall 2010 – Test 2

Part I: Multiple Choice Questions

1. The imaginary part of $(6+2i)(2-5i)$ is:
(A) 10 **(B)** -10 **(C)** $-26i$ **(D)** -26 **(E)** None of these

2. The remainder in division of $P(x) = 4x^{2010} - 3x^{2000} + 2x^{111} + 3$ by $(x+1)$ is:
(A) -6 **(B)** 6 **(C)** 2 **(D)** 5 **(E)** None of these

3. The domain of the function $f(x) = \dfrac{1}{\log x - 1}$ is:
(A) $(0,\infty)$ **(B)** $(0,1)\cup(1,\infty)$ **(C)** $(0,10)\cup(10,\infty)$ **(D)** $(1,\infty)$ **(E)** None of these

4. The function $y = 5 + 2e^x$ has asymptote
(A) $x = 5$ **(B)** $y = 0$ **(C)** $y = \dfrac{5}{2}$ **(D)** $y = 5$ **(E)** No asymptotes

5. If $\tan\theta = -\dfrac{5}{12}$ and θ is in quadrant II then $\sin\theta$ is:
(A) $\dfrac{5}{13}$ **(B)** $-\dfrac{5}{13}$ **(C)** $\dfrac{12}{13}$ **(D)** $-\dfrac{12}{13}$ **(E)** None of these

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Part II: Short Answer Questions
• This part is worth 40 marks out of 50. Simplify your answer when possible.
• To get full marks you have to show all necessary work.
• Write your answer in the space provided after the question.

1. (**6 marks**) Find the exact solution(s) of: $9^x - 3^{x+2} - 10 = 0$.

2. **(8 marks)** Sketch the graph of the rational function $r(x) = \dfrac{2(x+3)(x-1)}{x^2-4}$. Showing clearly all x- and y-intercepts and all asymptotes.

3. (**6 marks**) Find the exact solution(s) of: $\log(x+3) + \log(4-x) = \log(7-3x)$.

4. (**5+2 marks**) Let $P(x) = x^4 - 3x^3 + 5x^2 - 9x + 6$
(a) Factor P into linear and irreducible quadratic factors with real coefficients.
(b) Factor P completely into linear factors with complex coefficients.

5. (**6 marks**) The population of a town was estimated to be 80000 in 2010. The relative growth rate is estimated to be 2% per year. If the population continues to grow at this rate, when will it reach 240000?

6. (**7 marks**) A helicopter is flying at an elevation of 800 m directly above a straight highway. Two motorists are driving cars on the highway on opposite sides of the helicopter, and the angle of depression to one car is 40° and to the other is 55°. How far apart are the cars?

Math1106: Precalculus

Final Exam

Part I: Multiple Choice Questions

1. Simplify: $\dfrac{7^{2.7}}{7^{0.9}}$

(A) 7^3 **(B)** 1.8 **(C)** 3 **(D)** $7^{1.8}$ **(E)** None of these

2. Domain of $f(x) = \dfrac{12}{\sqrt{x} - 4}$ is

(A) $[0, 4) \cup (4, \infty)$ **(B)** $[0, \infty)$ **(C)** $[0, 16) \cup (16, \infty)$ **(D)** $(-\infty, 16) \cup (16, \infty)$ **(E)** None of these

3. The radius of the circle $x^2 - 2x + y^2 + 8y - 8 = 0$ is:

(A) 5 **(B)** 8 **(C)** 25 **(D)** 17 **(E)** None of these

4. The inverse function of $f(x) = 2 - 5x$ is

(A) $f^{-1}(x) = 5x - 2$ **(B)** $f^{-1}(x) = \dfrac{1}{2 - 5x}$ **(C)** $f^{-1}(x) = \dfrac{2 - x}{5}$ **(D)** $f^{-1}(x) = \dfrac{2 + x}{5}$ **(E)** None of these

5. The imaginary part of $(4 + 5i)(5 - 3i)$ is:

(A) $13i$ **(B)** -15 **(C)** 15 **(D)** 13 **(E)** None of these

6. Simplify $e^{4+3\ln(x-2)}$:

(A) $4 + 3(x - 2)$ **(B)** $e^4 (x - 2)^3$ **(C)** $4 + (x - 2)^3$ **(D)** $4(x - 2)^3$ **(E)** None of these

7. If $\theta = 1250°$, then the reference angle $\overline{\theta}$ is:

(A) $-10°$ **(B)** $80°$ **(C)** $170°$ **(D)** $50°$ **(E)** None of these

8. The exact value of $\cos^{-1}\left(\cos\left(\dfrac{4\pi}{3}\right)\right)$ is:

(A) $\dfrac{4\pi}{3}$ **(B)** $-\dfrac{\pi}{3}$ **(C)** $\dfrac{\pi}{3}$ **(D)** $\dfrac{2\pi}{3}$ **(E)** None of these

9. Which of the following equations doesn't have a solution?

(A) $\tan 4x = -2000$ **(B)** $\sqrt{3}\sin 2x = 2$ **(C)** $\cos^3 5x = -0.5$ **(D)** $\sin 5x = \dfrac{\pi}{4}$ **(E)** None of these

Part II: Short Answer Questions

- *This part has 12 questions for a total of 82 marks. To get full marks you have to show all necessary work.*
- *Write your answer in the space provided after the question. Simplify your answer as far as possible.*

1. (4+1+3 marks) A culture of bacteria grows exponentially. It contains 500 bacteria initially, and after 2 hours the bacteria count is 3000.
(a) What is the relative rate of growth of the bacteria population? Write your answer as a percentage.
(b) Find a function that models the population after t hours.
(c) When will the number of bacteria be 8000?

2. (8 marks) Solve the inequality $\log(x+3) + \log(4-x) \leq 1$ and write your answer in interval form.

3. (6 marks) Find a fourth-degree polynomial $p(x)$ with integer coefficients that has zeros $-2i$ and 1, where 1 as a zero of multiplicity 2, and with $p(2) = 4$. Write your answer in expanded form.

4. (1.5+1.5+3 marks) For $g(x) = 4 - 2^{x-1}$.
(a) Find all x- and y-intercepts.
(b) Explain in words how the graph of $y = g(x)$ can be obtained from the graph of $f(x) = 2^x$.
(c) Use the graph of $f(x) = 2^x$ to sketch the graph of $g(x) = 4 - 2^{x-1}$ and show clearly all intercepts and any asymptotes. (Show only the final graph.)

5. (4 marks) Verify the identity: $\dfrac{\sin 2x}{\sin x} - \dfrac{\cos 2x}{\cos x} = \dfrac{1}{\cos x}$.

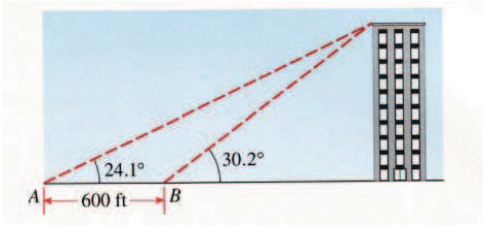
6. (2+4+4 marks) Let $r(x) = \dfrac{x^2-4}{x-1}$.
(a) Find all x- and y-intercepts.
(b) Find vertical and slant asymptotes, if any, and determine the behavior near vertical asymptote.
(c) Sketch the graph of $y = r(x)$.

7. (5 marks) Find exact solution(s) of $2\sqrt{4-x} = 1 - x$.

8. (10 marks) For $g(x) = -2\sin\left(\dfrac{\pi}{3}x + \dfrac{2\pi}{3}\right)$
(a) Find the amplitude, period, phase shift and an interval of one complete period of g.
(b) Sketch the graph of $y = g(x)$ in one complete period, clearly mark all x and y intercepts.

9. (5 marks) What quantity of a 65% acid solution must be mixed with a 40% acid solution to produce 500 mL of a 60% acid solution?

10. (6 marks) From a point A on the ground, the angle of elevation to the top of a tall building is $24.1°$. From a point B, which is 600 ft closer to the building, the angle of elevation is measured to be $30.2°$. Find the height of the building.



11. (6 marks) Find exact solutions of $\sin 2x - \sqrt{3}\cos x = 0$.

12. (5+3 marks) Let $f(x) = \dfrac{1}{e^x - 2}$ and $g(x) = \ln(5-x)$.
(a) Find $(f \circ g)$ and its domain in interval form.