

King Fahd University of Petroleum and Minerals
College of Sciences
Prep-Year Math Program

Key

Math 001 Exam II
Term 022 (2002-2003)
Saturday, April 26, 2003
Time Allowed: 90 Minutes

Key

Student's Name:

ID #:

Section #:

This exam consists of two parts:

Part I : Multiple Choice **Bubble the correct answer on the OMR sheet**
Part II : Written **Provide neat and complete solutions.**
 Show all necessary steps for full credit.

Calculators, pagers, or mobiles are NOT allowed during this examination.

Question	Points	Student's Score	Grader
Part I: Multiple Choice	12		
Part II: Written			
1	3		Mr Awad
2	3		Mr Awad
3	3		Mr Al-Labadi
4	4		Mr Al-Labadi
5	3		Mr Saleh
6	3		Mr Saleh
7	4		Mr Sharqawi
8	3		Mr Sharqawi
9	6		Mr Alzoubi

Total	
	44

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Part I: (12 points) Multiple Choice Questions (MCQ)**Bubble the correct answer on the OMR sheet.**1. Which one of the following relations **DOES NOT** define y as a function of x ?

(a) $\sqrt{x^2 + y^2} = 3$

(b) $\{(5, 10), (3, 10), (-3, 8), (-5, 6)\}$

(c) $x + y^3 = 1$

(d) $|x| - y = 5$

2. The solution set of the equation $\lceil \frac{1}{3}x \rceil = -1$, where $\lceil y \rceil$ is the greatest integer less than or equal to y , is equal to:

(a) $[-3, 0)$

(b) $[-6, -3)$

(c) $[-3, -1)$

(d) $[-3, -1]$

3. Which one of the following statements is **TRUE**?

(a) $\frac{3x(x^4-1)}{x^2+1} = 3x^3 - 3x$ is an identity.

(b) $x = 3$ and $x^2 = 9$ are equivalent equations.

(c) $\frac{x}{x-3} = \frac{3}{x-3}$ is a conditional equation.

(d) $2x = 3(x-1) - x + 3$ is a contradiction.

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4. If the circumference of a circle is 10 meters, then the area of the circle is equal to:

- (a) $\frac{25}{\pi}$ square meters
- (b) 25π square meters
- (c) $\frac{\pi}{25}$ square meters
- (d) 50π square meters

5. The line $2x + 3y + 6 = 0$

- (a) has y-intercept $(0, -2)$ and slope $\frac{-2}{3}$.
- (b) is parallel to the line $3x + 2y + 6 = 0$
- (c) is perpendicular to the line $2y = -3x$.
- (d) has y-intercept $(0, -2)$ and x-intercept $(3, 0)$

6. The equation $3x^2 + 4x = 5$ has:

- (a) two distinct irrational roots.
- (b) two equal real roots.
- (c) two distinct rational roots.
- (d) two distinct non-real roots.

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7. If the point (a, b) lies in quadrant *III*, then the point $(ab, -1)$ lies in quadrant

- (a) *IV*
- (b) *III*
- (c) *II*
- (d) *I*

8. The domain of $f(x) = \sqrt{\frac{x^2+1}{3-x}}$ is:

- (a) $(-\infty, 3)$
- (b) $(-\infty, 3) \cup (3, \infty)$
- (c) $(-3, -1)$
- (d) $(-3, -1) \cup (1, \infty)$

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Part II: Written Questions

Provide neat and complete solution to each question.
Show necessary steps for full credit.

1. (3 points) Write the complex number $z = \frac{\sqrt{-8}\sqrt{-4}+1}{1-i^{13}}$, where $i = \sqrt{-1}$, in standard form.

$$\begin{aligned} z &= \frac{(-2)(2i) + 1}{1-i} && \dots 1 \text{ point} \\ &= \frac{(1-4i)(1+i)}{(1-i)(1+i)} && \dots 1 \text{ point} \\ &= \frac{1-3i+4}{1+1} \\ &= \frac{5}{2} - \frac{3}{2}i && \dots 1 \text{ point} \end{aligned}$$

2. (3 points) Solve $4x^2 - 3x + 9 = x - 6$ by completing the square.

$$\begin{aligned} \Rightarrow 4x^2 - 4x &= -15 \\ \Rightarrow x^2 - x &= -\frac{15}{4} \\ \Rightarrow \left(x - \frac{1}{2}\right)^2 &= -\frac{15}{4} + \frac{1}{4} = -\frac{14}{4} \\ \Rightarrow x - \frac{1}{2} &= \pm i \frac{\sqrt{14}}{2} \\ \Rightarrow x &= \frac{1}{2} \pm i \frac{\sqrt{14}}{2} \end{aligned} \left. \begin{array}{l} \dots 2 \text{ point} \\ \dots 1 \text{ point} \end{array} \right\}$$

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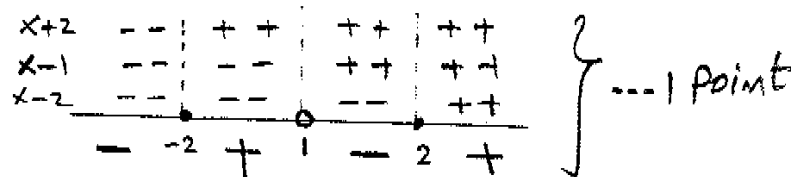
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3. (4 points) Solve the inequality $\frac{x-4}{x-1} \leq -x$, then write the solution set in interval notation.

$$\begin{aligned} \Rightarrow \frac{x-4}{x-1} + x &\leq 0 \\ \Rightarrow \frac{x-4+x^2-x}{x-1} &\leq 0 \\ \Rightarrow \frac{x^2-4}{x-1} &\leq 0 \\ \Rightarrow \frac{(x+2)(x-2)}{x-1} &\leq 0 \end{aligned} \quad \left. \begin{array}{l} \dots 2 \text{ points} \end{array} \right\}$$

The sign diagram is



$$\Rightarrow \text{The solution set} = (-\infty, -2] \cup (1, 2] \quad \dots 1 \text{ point}$$

4. (3 points) Find an equation of a circle that has a diameter with endpoints $(-1, -2)$ and $(7, -2)$. Write your answer in standard form.

The center is at $\left(\frac{-1+7}{2}, \frac{-2-2}{2}\right) = (3, -2) \quad \dots 1 \text{ point}$

The radius = The distance between $(3, -2)$ and $(-1, -2)$
or $(7, -2)$

$$= \sqrt{(3+1)^2 + (-2+2)^2} = \sqrt{(4)^2} = 4 \quad \dots 1 \text{ point}$$

\Rightarrow The required equation is

$$(x-3)^2 + (y+2)^2 = 16 \quad \dots 1 \text{ point}$$

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5. (3 points) Solve the compound inequality:

$$-4x + 5 > 9 \text{ AND } |x - 1| < 3.$$

(Write your answer in interval notation)

$$\Rightarrow -4x > 4 \quad \text{AND} \quad -3 < x-1 < 3 \quad \dots 1 \text{ point}$$

$$\Rightarrow x < -1 \quad \text{AND} \quad -2 < x < 4 \quad \dots 1 \text{ point}$$

$$\Rightarrow \text{The solution set} = (-2, -1) \quad \dots 1 \text{ point}$$

6. (3 points) Solve: $(8x + 8)^{\frac{2}{3}} - 3(x + 1)^{\frac{1}{3}} + 1 = 0$

$$\Rightarrow 4(x+1)^{\frac{2}{3}} - 3(x+1)^{\frac{1}{3}} - 1 = 0$$

$$\Rightarrow 4y^2 - 3y - 1 = 0, \text{ where } y = (x+1)^{\frac{1}{3}} \quad \dots 1 \text{ point}$$

$$\Rightarrow (4y + 1)(y - 1) = 0$$

$$\Rightarrow y = -\frac{1}{4} \text{ or } y = 1 \quad \dots 1 \text{ point}$$

$$\Rightarrow (x+1)^{\frac{1}{3}} = -\frac{1}{4} \Rightarrow x+1 = -\frac{1}{64} \Rightarrow x = -\frac{65}{64}$$

$$\text{OR } (x+1)^{\frac{1}{3}} = 1 \Rightarrow x+1 = 1 \Rightarrow x = 0 \quad \dots 1 \text{ point}$$

$$\Rightarrow \text{The solutions are: } -\frac{65}{64}, 0.$$

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7. (4 points) If the line through the points $(3k, -1)$ and $(2, k)$ is perpendicular to the line $2x - 5y + 1 = 0$, then find the value of k .

The slope of the line through $(3k, -1)$ and $(2, k)$
 $= \frac{k+1}{2-3k}$ --- 1 point

The slope of $2x - 5y + 1 = 0$ is $\frac{2}{5}$ --- 1 point

$$\Rightarrow \frac{k+1}{2-3k} = -\frac{5}{2} \quad \dots 1 \text{ point}$$

$$\Rightarrow 2k + 2 = -10 + 15k$$

$$\Rightarrow 13k = 12 \quad \Rightarrow k = \frac{12}{13} \quad \dots 1 \text{ point}$$

8. (3 points) Solve: $x = 2 + \sqrt{2-x}$

$$\Rightarrow x - 2 = \sqrt{2-x}$$

$$\Rightarrow x^2 - 4x + 4 = 2 - x \quad \left. \vphantom{\begin{matrix} \Rightarrow x^2 - 4x + 4 = 2 - x \\ \Rightarrow x^2 - 3x + 2 = 0 \end{matrix}} \right\} \dots 1 \text{ point}$$

$$\Rightarrow x^2 - 3x + 2 = 0$$

$$\Rightarrow (x-1)(x-2) = 0$$

$$\Rightarrow \text{Possible solutions are } 1, 2 \quad \left. \vphantom{\text{Possible solutions are } 1, 2} \right\} \dots 1 \text{ point}$$

$$\Rightarrow 2 \text{ checks as a solution, but } 1 \text{ does not}$$

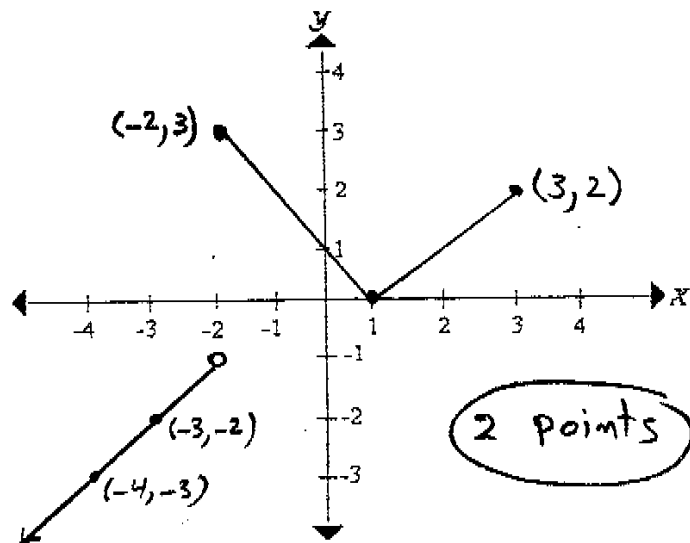
$$\Rightarrow 2 \text{ is the only solution.} \quad \left. \vphantom{\text{2 is the only solution.}} \right\} 1 \text{ point}$$

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9. (6 points) Given $f(x) = \begin{cases} x+1 & \text{if } x < -2 \\ |x-1| & \text{if } -2 \leq x \leq 3 \end{cases}$

(a) Sketch the graph of f .

(b) Use Part (a) to find:

i. The domain of $f = (-\infty, 3]$... 1 point

ii. The range of $f = (-\infty, -1) \cup [0, 3]$... 1 point

iii. The interval(s) over which f is increasing or decreasing.

A. Increasing on: $(-\infty, -1) \cup [1, 3]$... 1 point

B. Decreasing on: $[-2, 1]$... 1 point