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

Code 003

Math 002, Final Exam
Term (001)
Wednesday, January 10, 2001
7:00 - 9:15 p.m.

Code 003

STUDENT NAME:_____

ID #:_____ SECTION #:_____

Important Instructions

Use only 6 Digits I.D. # : i.e. Remove two zeros from 2000 of your ID#
(Example: ID# 20006587 should be bubbled as 206587)

Do not put any mark on a choice of any answer on the Exam Paper

1. All types of **Calculators, Pagers or Telephones are not allowed** during the examination.
2. **Use an HB 2.5 pencil.** Any mistake in bubbling your ID number will cost you one grade point.
3. Use a good eraser. **Do not use the eraser attached to the pencil.**
4. **Write your name, ID number and Mathematics Section number** on the examination paper and in the upper left corner of the answer sheet.
5. When bubbling **your ID number and Math Section number**, be sure that bubbles match with the number that you write.
6. The **test Code Number** is already typed and bubbled in your answer sheet. Make sure that it is **the same as that printed on your question paper.**
7. When erasing a bubble, make sure that you **do not leave any trace of pencilling.**
8. **Check** that the exam paper has **26** questions.

1. What is the direction angle θ and the magnitude $\|v\|$ of the vector $v = \sqrt{3}\,i - 3j$?

(a) $\theta = \dfrac{11\pi}{6}$, $\|v\| = 2\sqrt{3}$

(b) $\theta = \dfrac{2\pi}{3}$, $\|v\| = 2\sqrt{3}$

(c) $\theta = \dfrac{5\pi}{3}$, $\|v\| = 2\sqrt{3}$

(d) $\theta = \dfrac{5\pi}{3}$, $\|v\| = \sqrt{3}$

(e) $\theta = \dfrac{2\pi}{3}$, $\|v\| = \sqrt{3}$

2. The value of x in the equation

$$8^{2x-1} = 2\left(\frac{1}{16}\right)^{-1/2}$$

is:

(a) 1

(b) $\dfrac{1}{2}$

(c) 0

(d) 2

(e) -1

3. If $0 \leq x < 2\pi$ and $\sin x \tan^2 x = \sin^2 x - \sin x$ then the sum of all possible values of x equals

(a) 0

(b) $\frac{\pi}{2}$

(c) $-\frac{\pi}{2}$

(d) The sum is undefined because there is no solution.

(e) π

4. How many times does the graph of

$$y = 2\sin\left(\frac{x}{2}\right)$$

intersect the line $y = 1$ on the interval $0 \leq x \leq 2\pi$?

(a) 3

(b) 4

(c) 1

(d) 2

(e) 0

5. If $C = AB$ where

$$A = \begin{pmatrix} 1 & -1 & 0 & 1 \\ 2 & 3 & -1 & 4 \\ -1 & 2 & 1 & 3 \\ 0 & 1 & -1 & 0 \end{pmatrix}, \quad B = \begin{pmatrix} 2 & 1 & 0 & 1 \\ 1 & -1 & 2 & -1 \\ 0 & 1 & 1 & 1 \\ 1 & -1 & 0 & 2 \end{pmatrix}$$

then c_{32}, the third row and second column of C equals

(a) 5

(b) -5

(c) 6

(d) -6

(e) 0

6. A monic polynomial has real coefficients and the lowest possible degree. Two of its zeros are 3 and $2 + i$. This polynomial must be one of the following:

(a) $x^3 - 7x^2 + 15x - 9$

(b) $x^3 + x^2 - 13x + 3$

(c) $x^3 - 3x^2 + 5x - 15$

(d) $x^3 - 7x^2 + 17x - 15$

(e) $x^3 - 3x^2 + 4x - 12$

7. If the cost in thousands of SR of two computers and three printers is 7.5 and the cost of one computer and four printers is 5, then the cost of three computers and six printers is

(a) 12

(b) 10

(c) 21

(d) 9

(e) 15

8. What is the value of the following determinant?

$$\begin{vmatrix} -1 & 2 & 2 & 3 \\ 0 & 2 & 3 & 4 \\ 0 & 2 & 6 & 6 \\ 2 & -4 & -4 & -2 \end{vmatrix}$$

(a) 24

(b) -36

(c) -24

(d) 36

(e) 12

9. If $\alpha = \pi/3$ radians and β is the complementary angle of α, then $150° - \beta$ equals:

(a) 180°

(b) 90°

(c) 210°

(d) 30°

(e) 120°

10. The zeros of the polynomial

$$x^3 - 23x^2 + 167x - 385$$

are all positive integers. What is the sum of the zeros?

(a) 23

(b) 6

(c) 18

(d) 12

(e) 16

11. The exact value of $\tan(-22.5^\circ)$ equals

(a) $\sqrt{2}-1$

(b) $1-\sqrt{2}$

(c) $\sqrt{2}$

(d) $-\sqrt{2}$

(e) 1

12. Which one of the following statements is TRUE about the linear system of equations which has the augmented matrix

$$\left(\begin{array}{cccc|c} 1 & 2 & -1 & \vdots & 1 \\ 2 & 4 & -2 & \vdots & 0 \\ 1 & 2 & (c^2-1) & \vdots & c+1 \end{array}\right).$$

(a) The system is consistent if $c=0$, with infinitely many solutions.

(b) The system is consistent for all $c \neq 0$, with exactly one solution.

(c) The system can be made consistent for a suitable choice of c.

(d) The system is inconsistent for all values of c.

(e) The system is consistent for $c > 0$.

13. $\dfrac{\tan(\alpha+\beta)+\tan(\alpha-\beta)}{1-\tan(\alpha-\beta)\tan(\alpha+\beta)} =$

(a) $\tan(-2\beta)$

(b) $\tan(\alpha+\beta)$

(c) $\tan 2\alpha$

(d) $\tan(2\alpha+2\beta)$

(e) $\tan(2\alpha-2\beta)$

14. The exact value of

$$\sec\frac{7\pi}{6}+6\cot\frac{4\pi}{3}$$

equals

(a) $\dfrac{5\sqrt{3}}{3}$

(b) $\dfrac{7\sqrt{3}}{3}$

(c) $-\dfrac{7\sqrt{3}}{3}$

(d) $\dfrac{4\sqrt{3}}{3}$

(e) $-\dfrac{5\sqrt{3}}{3}$

15. In the adjacent figure, the angle of elevation measured from a point on the ground to the top of a pole which is 10 meters high is found to be 30°. The measurement is taken again after moving x meters closer to the pole and is found to be 45°. What is the value of x?

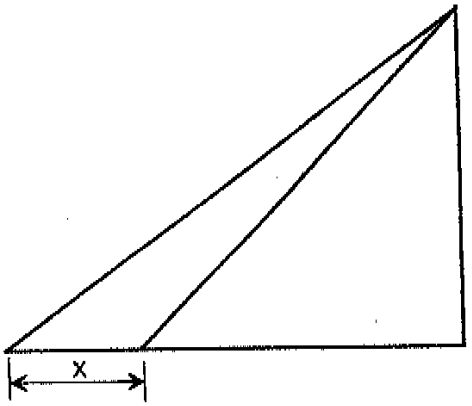
(a) $\sqrt{3}-1$

(b) $10\sqrt{3}$

(c) $10-\sqrt{3}$

(d) $10(\sqrt{3}-1)$

(e) $9\sqrt{3}$



16. The sum of all positive value of x and y which satisfy the equation

$$\cos(\arcsin x + \arccos\sqrt{1-y^2}) + \cos(\arcsin x - \arccos\sqrt{1-y^2}) = 0$$

is:

(a) 1

(b) 4

(c) 2

(d) 8

(e) none of the above

17. On the terminal side of a central angle θ, a point P has the coordinates $(3, -4)$. What is the value of $\tan\theta - \sin\theta$?

(a) $\frac{8}{15}$

(b) $-\frac{8}{15}$

(c) $\frac{1}{5}$

(d) 0

(e) -1

18. The matrix M and its inverse are given by

$$M = \begin{pmatrix} 2 & 2 & -1 \\ 0 & 3 & -1 \\ -1 & -2 & 1 \end{pmatrix}, \quad M^{-1} = \begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 2 \\ x & y & z \end{pmatrix}.$$

The sum $x + y + z$ equals

(a) 11

(b) 9

(c) 13

(d) 7

(e) 5

19. On the interval $[0, \infty)$, the adjacent graph represents

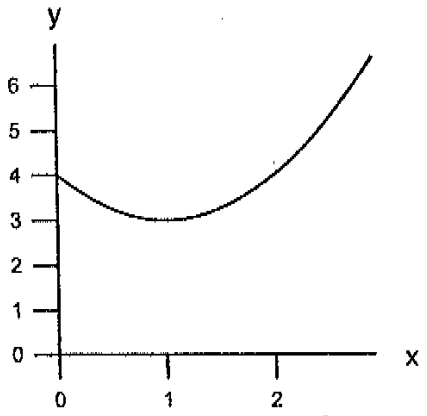
(a) $y = \dfrac{x^3 + 8}{x + 2}$

(b) $y = (x - 1)^2 + 2$

(c) $y = 4 - 4x + x^2$

(d) $y = \dfrac{x^3 - 8}{x - 2}$

(e) $y = x^2 + 2x + 4$



20. $\sin\beta\left[\dfrac{\cos(\alpha+\beta)}{\sin\beta\cos\beta} + \dfrac{\sin\alpha}{\cos\beta}\right] =$

(a) $\cos\beta$

(b) $\sin\alpha$

(c) $\cos\alpha$

(d) $\sin\beta$

(e) $\cos\alpha + \sin\beta$

21. The product of all solutions of the equation

$$\log(2-6x)+\log(8+x)=2$$

equals

(a) -14

(b) 42

(c) 7

(d) -42

(e) 14

22. If $(x,y,z)=(a,b,c)$ is the solution of the following system of equations, then what is the value of $a+b+c$?

$$\begin{aligned} 4x+8y+6z&=1\\ x+2y+z&=0\\ x+y-2z&=-1 \end{aligned}$$

(a) $-\frac{1}{2}$

(b) $1\frac{1}{2}$

(c) $-1\frac{1}{2}$

(d) 0

(e) $\frac{1}{2}$

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(b) $1\frac{1}{2}$

(c) $-1\frac{1}{2}$

(d) 0

(e) $\frac{1}{2}$

23. If P is the period, $P.S$ is the phase shift, and V is the vertical translation of the graph of the function

$$y = 4 + 2\cot(3x - 2\pi)$$

then

(a) $P = \frac{\pi}{3}$, $P.S. = \frac{2\pi}{3}$ units right , $V = 4$ units upward

(b) $P = \frac{2\pi}{3}$, $P.S. = \frac{2\pi}{3}$ units right , $V = 4$ units downward

(c) $P = \pi$, $P.S. = \frac{2\pi}{3}$ units to left , $V = 4$ units upward

(d) $P = \frac{\pi}{3}$, $P.S. = \frac{2\pi}{3}$ units right , $V = 4$ units downward

(e) $P = \frac{2\pi}{3}$, $P.S. = \frac{\pi}{3}$ units right , $V = 4$ units upward

24. The graph of

$$y = \frac{x^2 + 1}{ax^2 + bx + c}$$

has a horizontal asymptote $y = 1$ and two vertical asymptotes given by

$x = -3$ and $x = 1$.

What is the value of $2a + b + c$?

(a) -6

(b) 1

(c) 6

(d) -7

(e) -3

25. The amount in grams of a certain radioactive substance at time t is given by

$$A = \frac{A_0}{e^{t/10}}$$

where t is given in days. What is the half life, in days, of the substance?

(a) $5 \ln 2$

(b) $20 \ln 2$

(c) $2 \ln 10$

(d) $\ln 10$

(e) $10 \ln 2$

26. The solution of the following system is $(x, y, z) = (a, b, c)$:

$$\begin{aligned} x - \frac{1}{y} + \frac{2}{z} &= 1 \\ 3x + \frac{2}{y} + \frac{4}{z} &= 4 \\ \frac{1}{y} + \frac{2}{z} &= 5 \end{aligned}$$

What is the value of abc?

(a) 1

(b) -1

(c) -4

(d) 4

(e) 2