King Fahd University of Petroleum and Minerals
Prep-Math Program

MATH 002
SECOND MAJOR
TERM 231
11 NOVEMBER 2023

EXAM COVER

Number of versions: 2
Number of questions: 20

King Fahd University of Petroleum and Minerals
Prep-Math Program
MATH 002
SECOND MAJOR
TERM 231
11 NOVEMBER 2023
Net Time Allowed: 100 minutes

MASTER VERSION

1. The exact value of $\tan\left(-\frac{7\pi}{6}\right) + \sec\left(-\frac{\pi}{6}\right)$ is equal to

(a) $\frac{\sqrt{3}}{3}$ ————————————————————————————————(correct)

(b) $-\frac{\sqrt{3}}{3}$

(c) $-\frac{3\sqrt{3}}{2}$

(d) $-\frac{2\sqrt{3}}{3}$

(e) $\frac{\sqrt{3}}{2}$

2. The graph of the function $f(x) = -3\sin\left(\frac{1}{3}x\right)$, with $0 \le x \le 6\pi$, lies **completely below** the x-axis on the interval

(a) $(0, 3\pi)$ ——————————————————————————————(correct)

(b) $(0, 6\pi)$

(c) $(2\pi, 6\pi)$

(d) $(4\pi, 6\pi)$

(e) $(3\pi, 6\pi)$

3. Which one of the following statements is FALSE about the function

$$f(x) = 5\cos\left(3x - \frac{\pi}{4}\right) \ ?$$

(a) The graph of $f(x)$ has y-intercept at $y = -1$ _____(correct)

(b) The range of $f(x)$ is $[-5, 5]$

(c) The horizontal shift of the graph of $f(x)$ is $\frac{\pi}{12}$ units to the right

(d) The amplitude of the graph of $f(x)$ is 5

(e) The period of $f(x)$ is $\frac{2\pi}{3}$

4. The **number** of vertical asymptotes of the graph of the function

$$f(x) = 2 + 3\csc(2x - \pi) \ ,$$

on the interval $[-\pi, \pi]$ is equal to

(a) 5 _____(correct)

(b) 6

(c) 4

(d) 3

(e) 2

5. $\dfrac{4\tan x}{1+\tan^2 x} =$

   (a) $2\sin 2x$ ————————————————————————————(correct)

   (b) $2\cos 2x$

   (c) $2\cot 2x$

   (d) $2\sec 2x$

   (e) $2\csc 2x$

6. $(\sin^2 x)(1 + \cot x) + (\cos^2 x)(1 - \tan x) + \cot^2 x =$

   (a) $\csc^2 x$ ————————————————————————(correct)

   (b) $\sec^2 x$

   (c) $\cos^2 x$

   (d) $\sin^2 x$

   (e) $\tan^2 x$

7. The exact value of $\cos\left(\sin^{-1}\left(-\frac{3}{5}\right)\right)$ is equal to

(a) $\dfrac{4}{5}$ ————————————————————————————(correct)

(b) $-\dfrac{4}{5}$

(c) $\dfrac{3}{4}$

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

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

8. The **sum** of solutions of the equation $2\sin^2\frac{x}{2} = \cos x$, over the interval $[0, 2\pi)$ is equal to

(a) 2π ————————————————————————————(correct)

(b) π

(c) 3π

(d) 4π

(e) $-\pi$

9. If the **range** of the function $f(x) = 4 \sin x + 3 \cos x - 1$ is $[m, n]$,
   then $m + n =$

   (a) -2 ————————————————————————————(correct)

   (b) -3

   (c) -6

   (d) -1

   (e) -4

10. Which one of the following statements is TRUE ?

    (a) $\sin^{-1}\left(\frac{\pi}{5}\right)$ is defined ————————————————————(correct)

    (b) $\tan\left(\tan^{-1} 100\right)$ is undefined

    (c) $\cos\left(\cos^{-1}\left(-\frac{1}{2}\right)\right) = \frac{1}{2}$

    (d) $\tan^{-1} x = \dfrac{\sin^{-1} x}{\cos^{-1} x}$

    (e) The functions $y = \cos^{-1} x$ and $y = \sin^{-1} x$ have the same range

11. The exact value of $\sin 15° \left(8 - 16\sin^2(7.5°)\right)$ is equal to

    (a) 2 ————————————————————————————————————(correct)

    (b) 4

    (c) 8

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

    (e) $\dfrac{1}{4}$

12. The **number** of solutions of the equation $4\sin x \cos x = \sqrt{2}$, $0 \le x < 2\pi$, is

    (a) 4 ————————————————————————————————————(correct)

    (b) 1

    (c) 2

    (d) 3

    (e) 5

13. The exact value of $\dfrac{1 - \cot(70°)\cot(80°)}{\tan(20°) + \cot(80°)}$ is equal to

   (a) $\sqrt{3}$ —————————————————————————————————————(correct)

   (b) $2\sqrt{2}$

   (c) 1

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

   (e) $\dfrac{\sqrt{3}}{2}$

14. The graph of the function $f(x) = -\tan\left(\frac{\pi}{4}x - \frac{\pi}{2}\right)$, $0 < x < 8$,
    is **completely above** the x-axis on

   (a) $(0, 2) \cup (4, 6)$ ————————————————————————————(correct)

   (b) $(1, 3) \cup (5, 7)$

   (c) $(0, 3)$

   (d) $(0, 4)$

   (e) $(2, 4) \cup (6, 8)$

15. If x is in the **third quadrant**, then $\cot x$ in terms of $\sin x$ is

(a) $-\dfrac{\sqrt{1-\sin^2 x}}{\sin x}$ _____(correct)

(b) $\dfrac{\sqrt{1-\sin^2 x}}{\sin x}$

(c) $-\dfrac{\sin x}{\sqrt{1+\sin^2 x}}$

(d) $\dfrac{\sin x}{\sqrt{1+\sin^2 x}}$

(e) $-\dfrac{\sqrt{1-\sin x}}{\sin x}$

16. If $\tan x = \frac{12}{5}$ for all x is in the third quadrant, then $\cos x =$

(a) $-\dfrac{5}{13}$ _____(correct)

(b) $\dfrac{5}{13}$

(c) $-\dfrac{12}{13}$

(d) $\dfrac{12}{13}$

(e) $\dfrac{13}{5}$

17. The **range** of the graph of the function $f(x) = 1 - 2\csc x$ is

   (a) $(-\infty, -1] \cup [3, \infty)$ ————————————————————(correct)

   (b) $(-\infty, -2] \cup [2, \infty)$

   (c) $(-\infty, -3] \cup [2, \infty)$

   (d) $[1, \infty)$

   (e) $[-1, 3]$

18. $\cot \dfrac{x}{2} - \cos x \cot \dfrac{x}{2} =$

   (a) $\sin x$ ————————————————————(correct)

   (b) $\cos x$

   (c) $\tan x$

   (d) $\cot x$

   (e) $\csc x$

19. The **sum** of solutions of the equation $\cos 2x - \cos x = 0$, on the interval $[0, 2\pi)$ is

    (a) 2π ————————————————————————————————(correct)

    (b) π

    (c) 4π

    (d) 3π

    (e) 5π

20. If $\cos(x + y) = 1$, and $\cos(x - y) = 1$, then $\cos x \cos y =$

    (a) 1 ————————————————————————————————(correct)

    (b) -1

    (c) 2

    (d) -2

    (e) 0

King Fahd University of Petroleum and Minerals
Prep-Math Program

CODE001

MATH 002
SECOND MAJOR
TERM 231
11 NOVEMBER 2023
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Name	

ID		Sec	

Check that this exam has __20__ questions

Important Instructions:

1. All types of calculators, smart watches, mobile phones, or any other devices are NOT allowed during the examination.

2. Use HB 2.5 pencils only.

3. Use a good eraser. DO NOT use the erasers attached to the pencil.

4. Write your name, ID number and Section number on the examination paper and in the upper left corner of the answer sheet.

5. When bubbling your ID number and Section number, be sure that the bubbles match with the numbers that you write.

6. The Test Code Number is already bubbled in your answer sheet. Make sure that it is the same as that printed on your question paper.

7. When bubbling, make sure that the bubbled space is fully covered.

8. When erasing a bubble, make sure that you do not leave any trace of penciling.

1. The exact value of $\cos\left(\sin^{-1}\left(-\frac{3}{5}\right)\right)$ is equal to

   (a) $-\dfrac{4}{5}$

   (b) $\dfrac{3}{4}$

   (c) $-\dfrac{3}{4}$

   (d) $\dfrac{4}{5}$

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

2. If $\tan x = \frac{12}{5}$ for all x is in the third quadrant, then $\cos x =$

   (a) $\dfrac{5}{13}$

   (b) $\dfrac{12}{13}$

   (c) $-\dfrac{5}{13}$

   (d) $-\dfrac{12}{13}$

   (e) $\dfrac{13}{5}$

3. $(\sin^2 x)(1 + \cot x) + (\cos^2 x)(1 - \tan x) + \cot^2 x =$

(a) $\csc^2 x$

(b) $\tan^2 x$

(c) $\sec^2 x$

(d) $\cos^2 x$

(e) $\sin^2 x$

4. Which one of the following statements is FALSE about the function

$$f(x) = 5 \cos \left(3x - \frac{\pi}{4} \right) \ ?$$

(a) The amplitude of the graph of $f(x)$ is 5

(b) The horizontal shift of the graph of $f(x)$ is $\dfrac{\pi}{12}$ units to the right

(c) The range of $f(x)$ is $[-5, 5]$

(d) The period of $f(x)$ is $\dfrac{2\pi}{3}$

(e) The graph of $f(x)$ has y-intercept at $y = -1$

5. If the **range** of the function $f(x) = 4 \sin x + 3 \cos x - 1$ is $[m, n]$, then $m + n =$

(a) -3

(b) -4

(c) -6

(d) -1

(e) -2

6. The **number** of vertical asymptotes of the graph of the function

$$f(x) = 2 + 3 \csc (2x - \pi) \ ,$$

on the interval $[-\pi, \pi]$ is equal to

(a) 4

(b) 3

(c) 2

(d) 6

(e) 5

7. The graph of the function $f(x) = -3\sin\left(\frac{1}{3}x\right)$, with $0 \le x \le 6\pi$, lies **completely below** the x-axis on the interval

(a) $(0, 3\pi)$

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(c) $(3\pi, 6\pi)$

(d) $(4\pi, 6\pi)$

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8. $\dfrac{4\tan x}{1 + \tan^2 x} =$

(a) $2\csc 2x$

(b) $2\cot 2x$

(c) $2\sec 2x$

(d) $2\cos 2x$

(e) $2\sin 2x$

9. If x is in the **third quadrant**, then $\cot x$ in terms of $\sin x$ is

(a) $-\dfrac{\sqrt{1 - \sin x}}{\sin x}$

(b) $-\dfrac{\sqrt{1 - \sin^2 x}}{\sin x}$

(c) $\dfrac{\sin x}{\sqrt{1 + \sin^2 x}}$

(d) $\dfrac{\sqrt{1 - \sin^2 x}}{\sin x}$

(e) $-\dfrac{\sin x}{\sqrt{1 + \sin^2 x}}$

10. The graph of the function $f(x) = -\tan\left(\frac{\pi}{4}x - \frac{\pi}{2}\right)$, $0 < x < 8$, is **completely above** the x-axis on

(a) $(1, 3) \cup (5, 7)$

(b) $(2, 4) \cup (6, 8)$

(c) $(0, 2) \cup (4, 6)$

(d) $(0, 4)$

(e) $(0, 3)$

11. If $\cos(x + y) = 1$, and $\cos(x - y) = 1$, then $\cos x \cos y =$

    (a) -2

    (b) 2

    (c) 1

    (d) 0

    (e) -1

12. The **range** of the graph of the function $f(x) = 1 - 2\csc x$ is

    (a) $[-1, 3]$

    (b) $(-\infty, -2] \cup [2, \infty)$

    (c) $(-\infty, -1] \cup [3, \infty)$

    (d) $[1, \infty)$

    (e) $(-\infty, -3] \cup [2, \infty)$

13. The **number** of solutions of the equation $4 \sin x \cos x = \sqrt{2}$, $0 \le x < 2\pi$,   is

    (a) 5

    (b) 3

    (c) 2

    (d) 1

    (e) 4

14. The exact value of $\tan\left(-\frac{7\pi}{6}\right) + \sec\left(-\frac{\pi}{6}\right)$ is equal to

    (a) $\frac{\sqrt{3}}{3}$

    (b) $\frac{\sqrt{3}}{2}$

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

    (d) $-\frac{2\sqrt{3}}{3}$

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15. The **sum** of solutions of the equation $2\sin^2\frac{x}{2} = \cos x$,   over the interval $[0, 2\pi)$ is equal to

    (a) 2π

    (b) 4π

    (c) $-\pi$

    (d) π

    (e) 3π

16. The exact value of $\sin 15° \left(8 - 16\sin^2(7.5°)\right)$ is equal to

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

    (b) $\dfrac{1}{4}$

    (c)   2

    (d)   4

    (e)   8

17. Which one of the following statements is TRUE ?

    (a) $\tan\left(\tan^{-1} 100\right)$ is undefined

    (b) $\cos\left(\cos^{-1}\left(-\frac{1}{2}\right)\right) = \frac{1}{2}$

    (c) $\tan^{-1} x = \dfrac{\sin^{-1} x}{\cos^{-1} x}$

    (d) $\sin^{-1}\left(\frac{\pi}{5}\right)$ is   defined

    (e) The functions $y = \cos^{-1} x$ and $y = \sin^{-1} x$ have the same range

18. $\cot\dfrac{x}{2} - \cos x \cot\dfrac{x}{2} = $

    (a) $\tan x$

    (b) $\sin x$

    (c) $\cos x$

    (d) $\cot x$

    (e) $\csc x$

19. The exact value of $\dfrac{1 - \cot(70°)\cot(80°)}{\tan(20°) + \cot(80°)}$ is equal to

(a) 1

(b) $2\sqrt{2}$

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

(d) $\dfrac{\sqrt{3}}{2}$

(e) $\sqrt{3}$

20. The **sum** of solutions of the equation $\cos 2x - \cos x = 0$, on the interval $[0, 2\pi)$ is

(a) π

(b) 5π

(c) 3π

(d) 4π

(e) 2π

King Fahd University of Petroleum and Minerals

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CODE002

MATH 002
SECOND MAJOR
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(a) $-\dfrac{3}{4}$

(b) $-\dfrac{4}{5}$

(c) $\dfrac{4}{5}$

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

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

2. If x is in the **third quadrant**, then $\cot x$ in terms of $\sin x$ is

(a) $-\dfrac{\sqrt{1-\sin^2 x}}{\sin x}$

(b) $\dfrac{\sin x}{\sqrt{1+\sin^2 x}}$

(c) $\dfrac{\sqrt{1-\sin^2 x}}{\sin x}$

(d) $-\dfrac{\sqrt{1-\sin x}}{\sin x}$

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4. $(\sin^2 x)(1 + \cot x) + (\cos^2 x)(1 - \tan x) + \cot^2 x =$

(a) $\sin^2 x$

(b) $\csc^2 x$

(c) $\cos^2 x$

(d) $\tan^2 x$

(e) $\sec^2 x$

5. If $\tan x = \frac{12}{5}$ for all x is in the third quadrant, then $\cos x =$

(a) $-\dfrac{12}{13}$

(b) $\dfrac{13}{5}$

(c) $\dfrac{5}{13}$

(d) $-\dfrac{5}{13}$

(e) $\dfrac{12}{13}$

6. Which one of the following statements is TRUE ?

(a) The functions $y = \cos^{-1} x$ and $y = \sin^{-1} x$ have the same range

(b) $\tan\left(\tan^{-1} 100\right)$ is undefined

(c) $\sin^{-1}\left(\frac{\pi}{5}\right)$ is defined

(d) $\cos\left(\cos^{-1}\left(-\frac{1}{2}\right)\right) = \frac{1}{2}$

(e) $\tan^{-1} x = \dfrac{\sin^{-1} x}{\cos^{-1} x}$

7. The graph of the function $\quad f(x) = -\tan\left(\frac{\pi}{4}x - \frac{\pi}{2}\right)$, $\quad 0 < x < 8$, is **completely above** the x-axis on

    (a) $(0, 3)$

    (b) $(0, 2) \cup (4, 6)$

    (c) $(1, 3) \cup (5, 7)$

    (d) $(0, 4)$

    (e) $(2, 4) \cup (6, 8)$

8. The exact value of $\quad \dfrac{1 - \cot(70°)\cot(80°)}{\tan(20°) + \cot(80°)} \quad$ is equal to

    (a) $\dfrac{\sqrt{3}}{2}$

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

    (c) 1

    (d) $2\sqrt{2}$

    (e) $\sqrt{3}$

9. The **number** of vertical asymptotes of the graph of the function

$$f(x) = 2 + 3 \csc(2x - \pi) \ ,$$

on the interval $[-\pi, \pi]$ is equal to

    (a) 3

    (b) 2

    (c) 6

    (d) 4

    (e) 5

10. The **range** of the graph of the function $f(x) = 1 - 2\csc x$ is

    (a) $(-\infty, -3] \cup [2, \infty)$

    (b) $[-1, 3]$

    (c) $[1, \infty)$

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    (e) $(-\infty, -2] \cup [2, \infty)$

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(a) $(0, 6\pi)$

(b) $(4\pi, 6\pi)$

(c) $(3\pi, 6\pi)$

(d) $(0, 3\pi)$

(e) $(2\pi, 6\pi)$

13. $\dfrac{4\tan x}{1+\tan^2 x} =$

   (a) $2\csc 2x$

   (b) $2\cos 2x$

   (c) $2\cot 2x$

   (d) $2\sec 2x$

   (e) $2\sin 2x$

14. If $\cos(x + y) = 1$, and $\cos(x - y) = 1$,   then $\cos x \cos y =$

   (a)   1

   (b)   2

   (c) -2

   (d)   0

   (e) -1

15. If the **range** of the function $f(x) = 4\sin x + 3\cos x - 1$ is $[m, n]$, then $m + n =$

    (a) -1

    (b) -3

    (c) -2

    (d) -6

    (e) -4

16. The **number** of solutions of the equation $4\sin x \cos x = \sqrt{2}$, $0 \le x < 2\pi$, is

    (a) 1

    (b) 4

    (c) 3

    (d) 5

    (e) 2

17. $\cot \dfrac{x}{2} - \cos x \cot \dfrac{x}{2} =$

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(a) 2π

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(c) 4π

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19. The exact value of $\quad \sin 15° \left(8 - 16 \sin^2(7.5°)\right)\quad$ is equal to

(a) 8

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

(c) 2

(d) 4

(e) $\dfrac{1}{4}$

20. The **sum** of solutions of the equation $\cos 2x - \cos x = 0$, on the interval $[0, 2\pi)$ is

(a) 4π

(b) 3π

(c) 5π

(d) 2π

(e) π

Q	MASTER	CODE001	CODE002
1	A	D $_7$	C $_7$
2	A	C $_{16}$	A $_{15}$
3	A	A $_6$	C $_3$
4	A	E $_3$	B $_6$
5	A	E $_9$	D $_{16}$
6	A	E $_4$	C $_{10}$
7	A	A $_2$	B $_{14}$
8	A	E $_5$	E $_{13}$
9	A	B $_{15}$	E $_4$
10	A	C $_{14}$	D $_{17}$
11	A	C $_{20}$	A $_1$
12	A	C $_{17}$	D $_2$
13	A	E $_{12}$	E $_5$
14	A	A $_1$	A $_{20}$
15	A	A $_8$	C $_9$
16	A	C $_{11}$	B $_{12}$
17	A	D $_{10}$	E $_{18}$
18	A	B $_{18}$	A $_8$
19	A	E $_{13}$	C $_{11}$
20	A	E $_{19}$	D $_{19}$

Answer Counts

V	A	B	C	D	E
1	4	2	5	2	7
2	4	3	5	4	4