Directions: Fill in the following in the appropriate spaces on the answer sheet and darken the corresponding ovals:

1. Last name, first and middle initials.
2. Student Z Number. (LEFT-justify in the ID field.)
3. Section:
   
   A1=11        B1=21        C1=31
   A2=12        B2=22        C2=32
   A3=13        B3=23        C3=33
   A4=14        B4=24
   A5=15        B5=25
   A6=16        B6=26
4. Your signature on the back.
5. No Scratch paper outside of the Exam is permitted.
6. Only a basic non-text capable, non-graphing calculator is permitted.
7. Graphing calculators, cell phones and pdas shall be stowed out of sight. IF VISIBLE YOU WILL BE DEEMED TO BE CHEATING AND WILL RECEIVE A ZERO SCORE FOR THE EXAM!!!
8. Check that your exam contains exactly 50 problems. Each problem is worth 5 points.

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[1A] Simplify $x^{-1/2}x^{1/4}$

(a) $x^{-1/8}$
(b) $x^{-1/4}$
(c) $x^{1/4}$
(d) $x^{1/8}$
(e) None of the above

[2A] Simplify $\frac{2x^2 - 5xy - 3y^2}{2x + y}$.

(a) $x - 3y$
(b) $x + 3y$
(c) $3x + y$
(d) $3x - y$
(e) None of the above
[3A] Factor the expression \(x^{2/3}(x + 2) - x^{5/3} + 6x^{-1/3}\).

(a) \(2x^{5/3}(x + 3)\)  
(b) \(2x^{1/3}(x + 3)\)  
(c) \(2x^{1/3}(3x + 1)\)  
(d) \(6x^{-1/3}(x + 1)\)  
(e) None of the above

[4A] Simplify \(\frac{3\sqrt{3}+1}{3\sqrt{3}-2}\)

(a) \(\frac{1}{27}\)  
(b) \(1\)  
(c) \(27\)  
(d) \(3\sqrt{3}\)  
(e) None of the above

[5A] If \(f(t) = \frac{t - 2}{3}\), then \(f^{-1}(t) =\)

(a) \(\frac{3}{t - 2}\)  
(b) \(\frac{3}{t + 2}\)  
(c) \(3t + 2\)  
(d) \(3t - 2\)  
(e) None of the above

[6A] If \(f(x) = x^2 + 2x\) then \(\frac{f(1 + h) - f(1)}{h} =\)

(a) \(h\)  
(b) \(h + 4\)  
(c) \(-h - 2\)  
(d) \(1\)  
(e) None of the above

[7A] If \(f(x) = -3x + 4\) and \(g(x) = 2x - 1\), find the product \((fg)(x)\) and the composition \((f \circ g)(x)\).

(a) \((fg)(x) = -6x^2 + 11x - 4\) and \((f \circ g)(x) = -6x + 7\) 
(b) \((fg)(x) = 6x^2 + 5x - 4\) and \((f \circ g)(x) = 6x + 7\) 
(c) \((fg)(x) = 6x^2 - 5x - 4\) and \((f \circ g)(x) = 6x - 7\) 
(d) \((fg)(x) = 6x^2 - 23x - 20\) and \((f \circ g)(x) = 6x + 3\) 
(e) None of the above
[8A] Let \( f(x) = -g(x + 2) \) for some function \( g(x) \). To obtain the graph of \( f(x) \) we can:

(a) shift the graph of \( g(x) \) left 2 units then reflect around the \( x \)-axis.
(b) shift the graph of \( g(x) \) left 2 units then reflect around the \( y \)-axis.
(c) shift the graph of \( g(x) \) right 2 units then reflect around the \( x \)-axis.
(d) shift the graph of \( g(x) \) right 2 units then reflect around the \( y \)-axis.
(e) None of the above

[9A] What is the domain of the function \( f(x) = \frac{x + 3}{\sqrt{2 - x}} \)?

(a) \((-\infty, 2]\)  
(d) \((2, \infty)\)
(b) \((-\infty, 2)\)  
(e) \((-\infty, 2) \cup (2, \infty)\)
(c) \([2, \infty)\)

[10A] A wire with length 2 is bent into the shape of a circle. What is the area \( A \) of the circle?

(a) \(4\pi\)  
(d) \(4/\pi\)
(b) \(1/\pi\)  
(e) None of these
(c) \(2/\pi\)

[11A] The population of a small town obeys the exponential law. If the population increased from 5,000 to 10,000 from 2008 to 2010, what will the population be in 2014?

(a) 40,000  
(d) 120,000
(b) 60,000  
(e) None of the above
(c) 80,000

[12A] Find the vertex of the parabola \( 3y = x^2 + 4x + 13 \).

(a) \((-2, 3)\)  
(d) \((2, -3)\)
(b) \((-2, -3)\)  
(e) None of the above
(c) \((2, 3)\)

[13A] The graph of \( 2x^2 - 3y^2 - 6x = 0 \) is:

(a) a circle  
(d) an ellipse but not a circle
(b) a line  
(e) a hyperbola
(c) a parabola
[14A] The graph of $2x^2 + 3y^2 - 6x = 0$ is:

(a) a circle  
(b) a line  
(c) a parabola  
(d) an ellipse but not a circle  
(e) a hyperbola

[15A] Where does the curve $9x^2 + 4y^2 = 36$ cross the y-axis?

(a) Never  
(b) $(-2,0)$ and $(2,0)$  
(c) $(-3,0)$ and $(3,0)$  
(d) $(0,-2)$ and $(0,2)$  
(e) $(0,-3)$ and $(0,3)$

[16A] Evaluate $\log_5 1$.

(a) 0  
(b) 1  
(c) $e$  
(d) Undefined  
(e) None of the above

[17A] Evaluate $\log_5 0$.

(a) 0  
(b) 1  
(c) $e$  
(d) Undefined  
(e) None of the above

[18A] Evaluate $e^0$.

(a) 0  
(b) 1  
(c) $e$  
(d) Undefined  
(e) None of the above

[19A] Which is the largest?

(a) $\ln(e^2)$  
(b) $e$  
(c) $\sqrt{2}$  
(d) $\log_3 \sqrt{3}$  
(e) $1$

[20A] Which ONE of the following is always true for a general logarithm function $G(x) = \log_b(x)$, $b > 0, b \neq 1$?

(a) The function is increasing  
(b) The function is decreasing  
(c) The x-axis is an asymptote  
(d) The graph crosses the y-axis at $y = 1$  
(e) The graph crosses the x-axis at $x = 1$
[21A] Which ONE of the following is always true for a general exponential function $F(x) = b^x$, $b > 0, b \neq 1$?

(a) The function is increasing
(b) The function is decreasing
(c) The y-axis is an asymptote
(d) The graph crosses the y-axis at $y = 1$
(e) The graph crosses the x-axis at $x = 1$

[22A] Simplify $\frac{\ln a}{\ln a^2}$ for $a > 0$.

(a) $\ln a$
(b) $\ln \frac{1}{a}$
(c) 2
(d) $\frac{1}{2}$
(e) None of the above

[23A] Simplify $\frac{e^{3x}}{e^{2x}}$

(a) $e^{3/2}$
(b) $\frac{3}{2}$
(c) $e^x$
(d) $e^{3x} - e^{2x}$
(e) None of the above

[24A] Convert polar coordinates of $(2, -\frac{\pi}{2})$ to rectangular coordinates:

(a) $(-2, 0)$
(b) $(0, 2)$
(c) $(0, 2)$
(d) $(0, -2)$
(e) None of the above

[25A] Convert rectangular coordinates of $(\sqrt{2}, -\sqrt{2})$ to polar coordinates:

(a) The only possible polar coordinate is $(\sqrt{2}, \frac{3\pi}{4})$
(b) The only possible polar coordinate is $(2, -\frac{\pi}{4})$
(c) Possible polar coordinates are $(2, -\frac{\pi}{4})$ and $(-2, \frac{\pi}{4})$
(d) Possible polar coordinates are $(2, -\frac{\pi}{4})$ and $(-2, \frac{3\pi}{4})$
(e) None of the above
[26A] Which of the following is the polar graph of \( r = 2 \)?

(a) ![Graph A]
(b) ![Graph B]
(c) ![Graph C]
(d) ![Graph D]
(e) ![Graph E]

[27A] Which of the following is the polar graph of \( \theta = \frac{5\pi}{4} \)?

(a) ![Graph A]
(b) ![Graph B]
(c) ![Graph C]
(d) ![Graph D]
(e) ![Graph E]

[28A] Two angles of a triangle are \( \frac{\pi}{6} \) and \( \frac{2\pi}{5} \). What is the third angle?

(a) \( \frac{13\pi}{30} \)  
(b) \( \frac{17\pi}{30} \)  
(c) \( \frac{7\pi}{30} \)  
(d) \( \frac{\pi}{6} \)  
(e) None of the above

[29A] Suppose that \( \triangle ABC \) is a right triangle with \( \angle C = \frac{\pi}{2} \). If \( AC = 3 \) and \( AB = 5 \), then:

(a) \( \cos B = \frac{3}{5} \ & \sin B = \frac{4}{5} \ & \tan B = \frac{4}{3} \)  
(b) \( \cos B = \frac{4}{5} \ & \sin B = \frac{3}{5} \ & \tan B = \frac{3}{4} \)  
(c) \( \cos B = \frac{3}{5} \ & \sin B = \frac{4}{5} \ & \tan B = \frac{3}{4} \)  
(d) \( \cos B = \frac{4}{5} \ & \sin B = \frac{3}{5} \ & \tan B = \frac{4}{3} \)  
(e) None of the above are true.
[30A] Evaluate $\cos \frac{\pi}{2}$.
(a) 0 (d) 2
(b) 1 (e) None of the above
(c) −1

[31A] Evaluate: $2 \cos \left( -\frac{3\pi}{4} \right)$
(a) $\sqrt{2}$ (d) $-2\sqrt{2}$
(b) $-\sqrt{2}$ (e) None of the above
(c) $2\sqrt{2}$

[32A] Evaluate $\tan \left( \frac{\pi}{3} \right)$
(a) $\frac{1}{\sqrt{3}}$ (d) 1
(b) $\frac{\sqrt{3}}{3}$ (e) None of the above
(c) $\sqrt{3}$

[33A] What is the amplitude of $f(x) = -7\sin(4x - 3)$?
(a) 4 (c) −4 (e) None of the above
(b) 7 (d) −7

[34A] What is the period of $f(x) = -4\sin(7x - 3)$?
(a) $2\pi$ (c) $\frac{2\pi}{7}$ (e) None of the above
(b) $\frac{2\pi}{3}$ (d) $\frac{\pi}{2}$

[35A] What is the phase shift of $f(x) = -7\sin(3x - 4)$?
(a) 4 (c) $\frac{19\pi}{2}$ (e) None of the above
(b) 7 (d) $\frac{\pi}{2}$
If \( \sin \alpha = -\frac{1}{3} \) with \( \pi < \alpha < \frac{3\pi}{2} \) and \( \cos \beta = -\frac{3}{5} \) with \( \frac{\pi}{2} < \beta < \pi \):  

Find the exact value of \( \cos(\alpha + \beta) \): 

(a) \( \frac{6\sqrt{2} + 4}{15} \)  
(b) \( \frac{6\sqrt{2} - 4}{15} \)  
(c) \( \frac{3 + 8\sqrt{2}}{15} \)  
(d) \( \frac{3 - 8\sqrt{2}}{15} \)  
(e) None of the above

Simplify \( \frac{\sin 2x}{\sin x} \). 

(a) 2  
(b) \( 2\sin x \)  
(c) \( 2\cos x \)  
(d) \( 2\tan x \)  
(e) None of the above

Solve \( \cos^2 \theta - 6 \cos \theta + 9 = 0 \). 

(a) Either \( \theta = \cos^{-1}(-2) \) or \( \theta = \cos^{-1}(2) \)  
(b) \( \theta = \cos^{-1}(-2) + 2k\pi \)  
(c) \( \theta = \cos^{-1}(2) + 2k\pi \)  
(d) No solution  
(e) None of the above
[39A] Which is the graph of \( y = -\sin 2x \)?

(a) \hspace{1cm} (b) 

(c) \hspace{1cm} (d) 

(e) 

[40A] Solve \( 2 \sin^2 \theta - 2 \cos^2 \theta = \sqrt{2} \).

(a) \( \theta = \pm \frac{\pi}{8} + k\pi \)  
(b) \( \theta = \pm \frac{\pi}{4} + k\pi \)  
(c) \( \theta = \pm \frac{3\pi}{8} + k\pi \)  
(d) \( \theta = \pm \frac{3\pi}{4} + k\pi \)  
(e) None of the above
Simplify and evaluate \( \sin \left( \frac{13\pi}{21} \right) \cos \left( \frac{2\pi}{7} \right) - \cos \left( \frac{13\pi}{21} \right) \sin \left( \frac{2\pi}{7} \right) \).

(a) \( \frac{\sqrt{2}}{2} \)  
(b) \( -\frac{\sqrt{2}}{2} \)

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

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

Simplify \( \cos^{-1} \left( \cos \left( -\frac{2\pi}{9} \right) \right) \)

(a) \( -\frac{2\pi}{9} \)  
(b) \( \frac{2\pi}{9} \)

(c) \( -\frac{7\pi}{9} \)  
(d) \( \frac{7\pi}{9} \)

(e) None of the above

Simplify \( \cos \left( \cos^{-1} \left( -\frac{2\pi}{9} \right) \right) \)

(a) \( -\frac{2\pi}{9} \)  
(b) \( \frac{2\pi}{9} \)

(c) \( -\frac{7\pi}{9} \)  
(d) \( \frac{7\pi}{9} \)

(e) None of the above

A triangle has sides of length \( a, b, c \) opposite angles \( A, B, C \) respectively.

If \( a = 5, b = 3 \) and \( c = 6 \), then

(a) \( \cos B = \frac{3^2 + 6^2 - 5^2}{2 \cdot 3 \cdot 6} \)

(b) \( \cos B = \frac{5^2 + 6^2 - 3^2}{2 \cdot 5 \cdot 6} \)

(c) \( \cos B = \frac{3^2 + 5^2 + 6^2}{2 \cdot 5 \cdot 6} \)

(d) There is such a triangle but \( \cos(B) \) is not as above.

(e) No such triangle is possible.

A triangle has sides of length \( a, b, c \) opposite angles \( A, B, C \) respectively.

If \( \sin A = \frac{1}{6} \), \( \sin(B) = \frac{1}{10} \) and \( a = 20 \), then

(a) \( b = 6 \)  
(b) \( b = 12 \)

(c) \( b = 18 \)  
(d) \( b = 40 \)

(e) None of the above.
[46A] Find the area of the sector of radius 20 in. and central angle 9°.

\[ A = \frac{1}{2} \theta r^2 \text{ when the angle is in radians.} \]

(a) \(5\pi \text{ in}^2\) \hspace{1cm} (d) \(10\pi \text{ in}^2\)
(b) \(90\pi \text{ in}^2\) \hspace{1cm} (e) None of the above
(c) \(18\pi \text{ in}^2\)

[47A] A triangle has sides of length \(a, b, c\) opposite angles \(A, B, C\) respectively. If \(b = 7\), \(a = 8\), and \(B = \sin^{-1}(\frac{1}{8})\), then

(a) \(A = \sin^{-1}(\frac{1}{7})\) only
(b) \(A = \pi - \sin^{-1}(\frac{1}{7})\) only
(c) Either \(A = \sin^{-1}(\frac{1}{7})\) or \(A = \pi - \sin^{-1}(\frac{1}{7})\)
(d) There is such a triangle but \(A\) is not as above
(e) No such triangle is possible

[48A] A triangle has sides of length \(a, b, c\) opposite angles \(A, B, C\) respectively. If \(b = 7\), \(a = 5\), and \(B = \sin^{-1}(\frac{1}{5})\), then

(a) \(A = \sin^{-1}(\frac{1}{7})\) only
(b) \(A = \pi - \sin^{-1}(\frac{1}{7})\) only
(c) Either \(A = \sin^{-1}(\frac{1}{7})\) or \(A = \pi - \sin^{-1}(\frac{1}{7})\)
(d) There is such a triangle but \(A\) is not as above
(e) No such triangle is possible
Simplify \(\frac{1}{\csc x} \left(\frac{1}{\sin x} - \sin x\right)\)

(a) \(2 \cos^2 x - 1\) \hspace{1cm} (d) \(\sin^2 x\)

(b) \(-\cos^2 x\) \hspace{1cm} (e) None of the above

(c) \(2 \sin^2 x - 1\)

Simplify \(\frac{\tan^2 \beta}{\sec \beta + 1} - \frac{\tan^2 \beta}{\sec \beta - 1}\)

(a) \(2 \cos^2 \beta\) \hspace{1cm} (d) 2

(b) \(2 \sin^2 \beta\) \hspace{1cm} (e) None of the above

(c) \(-2\)