

Department of Mathematical Sciences  
KFUPM  
Term 051

**MATH 101-06, 13/ Final Exam/ Time allowed=3 Hours  
Code 001**

Name:

ID#:

Sec#:

Each correctly answered question will be given 2 marks. For the first 17 questions, circle the letter before the correct answer. All type of Calculators and Mobiles are not allowed.

1.  $\lim_{x \rightarrow -2} \frac{\sin(x^3 + 3x^2 + 3x + 2)}{\sin(x^2 + 3x + 2)} =$   
a)  $-\infty$    b)  $-3$    c)  $0$    d)  $1$    e)  $3$    f)  $2$    g)  $+\infty$    h) DNE   i) NP.

2.  $\lim_{x \rightarrow +\infty} \frac{\sin(x^5 - x^3)}{x} \sin\left(\frac{1}{x^4 - x^2}\right) =$   
a)  $-\infty$    b)  $0$    c)  $-1$    d)  $1$    e)  $+\infty$    f) DNE   g) NP.

3.  $\lim_{x \rightarrow 0} \frac{\sqrt[3]{6}}{x^2} - \frac{\sin(\sqrt[3]{6}x)}{x^3} =$   
a)  $-\infty$    b)  $0$    c)  $1$    d)  $6$    e)  $+\infty$    f) DNE   g) NP.

4.  $\lim_{x \rightarrow 0} (1 + \tan(2x))^{\frac{1}{\ln(1 + \sin x)}} =$   
a)  $1$    b)  $\sqrt{e}$    c)  $e$    d)  $e^2$    e)  $+\infty$    f) DNE   g) NP.

5.  $\lim_{x \rightarrow 2} \frac{x^x - 2^2}{(1 + \ln 2)(x - 2)} =$   
a)  $0$    b)  $2$    c)  $\ln 2$    d)  $2^2$    e)  $2^{-2}$    f)  $+\infty$    g) DNE   h) NP.

6. The local linear approximation of  $\sqrt[3]{28}$  to 3 decimal places is  
a) 3.031   b) 3.033   c) 3.035   d) 3.037   e) 3.039   f) 3.041   g) NP.

7. An equation of the tangent line to the curve  $\tan^{-1}(2x) - \tan^{-1}(y) = \frac{\pi}{2}$  at  $(1/2, -1)$  is  
a)  $y = -2x$    b)  $y = -1/2 - x$    c)  $y = x - 3/2$    d)  $y = 2x - 2$   
e)  $y = 4x - 3$    f)  $y = -3x + 1/2$    g) NP.

8. If the side of a cube is measured to be  $30\text{cm}$  with an error of  $0.01\text{cm}$ , then the error in calculating the volume of the cube is  
a)  $9\text{cm}^3$    b)  $18\text{cm}^3$    c)  $27\text{cm}^3$    d)  $36\text{cm}^3$    e)  $45\text{cm}^3$    f)  $54\text{cm}^3$    g) NP.

9.  $\cos^{-1}\left(\cos\left(\frac{53\pi}{9}\right)\right) =$   
 a)  $\frac{\pi}{9}$     b)  $\frac{2\pi}{9}$     c)  $\frac{\pi}{3}$     d)  $\frac{4\pi}{9}$     e)  $\frac{5\pi}{9}$     f)  $\frac{8\pi}{9}$     g) NP.
10. If  $f(x) = \frac{\ln(x) - \ln(2)}{\ln(x) - 2\ln(2)}$ , then  $f^{-1}(x)$  is  
 a)  $2^{\frac{x-1}{2}}$     b)  $2^{\frac{2x+1}{x+1}}$     c)  $2^{\frac{x-1}{x+1}}$     d)  $2^{\frac{2x-1}{x-1}}$     e)  $2^{\frac{2x-1}{x+1}}$     f)  $2^{\frac{2x+1}{x-1}}$     g) NP.
11. The derivative of  $\log_{\sin(x^2)}(e)$  is  
 a)  $\frac{-2x}{\cot(x^2)\ln^2(\sin(x^2))}$     b)  $\frac{-x}{\cot(x^2)\ln^2(\sin(x^2))}$   
 c)  $\frac{-1}{\tan(x^2)\ln^2(\sin(x^2))}$     d)  $\frac{-2x}{\tan(x^2)\ln^2(\sin(x^2))}$     e)  $\frac{-2x}{\cos(x^2)\ln(\sin(x^2))}$     f) NP.
12. If a man  $6ft$  tall is walking away from a streetlight at a rate of  $2ft/s$ , and his shadow length is changing at the rate of  $1ft/s$ , then the streetlight length is  
 a)  $12ft$     b)  $16ft$     c)  $18ft$     d)  $24ft$     e)  $30ft$     f)  $36ft$     g) NP.
13. The function  $f(x) = 2e^x - 2x^2 + 2\ln^2(2) - 4$  has at  $x = \ln 2$   
 a) a vertical tangent line    b) a cusp    c) a relative minimum  
 d) an inflection point    e) a relative maximum    f) a critical point    g) NP.
14. The critical points of the function  $f(x) = \frac{1}{x-1} + |x^2 - 4x|$  are  
 a) 0, 1, 4    b) 0, 1, 2, 4    c) 0, 2, 4    d) 0, 4    e) NP.
15. If the position of a particle moving along an  $s$ -axis is given by  $s(t) = t^3 - 3t^2$ , then the distance traveled during the time interval  $[0, 4]$  is  
 a) 12    b) 16    c) 20    d) 24    e) 30    f) NP.
16. If the highest position reached by a projectile launched upward from ground level is  $20m$ , then its initial speed is (take  $g \approx 10m/s^2$ )  
 a)  $5m/s$     b)  $10m/s$     c)  $20m/s$     d)  $30m/s$     e)  $40m/s$     f) NP.
17. If Newton's method is used to approximate  $\sqrt[3]{2}$ , and if  $x_1 = 1$ , then  $x_3$  is equal to  
 a)  $44/35$     b)  $54/47$     c)  $75/64$     d)  $81/73$     e)  $91/72$     f) NP.
18. Find the dimensions of a rectangle with perimeter  $200m$  whose area is as large as possible.

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Each correctly answered question will be given 2 marks. For the first 17 questions, circle the letter before the correct answer. All type of Calculators and Mobiles are not allowed.

1.  $\lim_{x \rightarrow -3} \frac{\sin(x^3 + 4x^2 + 4x + 3)}{\sin(x^2 + 4x + 3)} =$   
a)  $-\infty$     b)  $-9/2$     c)  $-7/2$     d) 0    e)  $5/2$     f)  $7/2$     g)  $+\infty$     h) DNE    i) NP.

2.  $\lim_{x \rightarrow +\infty} \frac{\sin(x^6 - x^4)}{x} \sin\left(\frac{1}{x^5 - x^3}\right) =$   
a)  $-\infty$     b) 0    c) -1    d) 1    e)  $+\infty$     f) DNE    g) NP.

3.  $\lim_{x \rightarrow 0} \frac{\sqrt[3]{12}}{x^2} - \frac{\sin(\sqrt[3]{12}x)}{x^3} =$   
a)  $-\infty$     b) 0    c) 1    d) 2    e)  $+\infty$     f) DNE    g) NP.

4.  $\lim_{x \rightarrow 0} (1 + \tan(3x))^{\frac{1}{\ln(1 + \sin x)}} =$   
a) 1    b)  $\sqrt[3]{e}$     c)  $e$     d)  $e^3$     e)  $+\infty$     f) DNE    g) NP.

5.  $\lim_{x \rightarrow 3} \frac{x^x - 3^3}{(1 + \ln 3)(x - 3)} =$   
a) 0    b) 3    c)  $\ln 3$     d)  $3^3$     e)  $3^{-3}$     f)  $+\infty$     g) DNE    h) NP.

6. The local linear approximation of  $\sqrt[3]{66}$  to 3 decimal places is  
a) 4.050    b) 4.048    c) 4.046    d) 4.044    e) 4.042    f) 4.040    g) NP.

7. An equation of the tangent line to the curve  $\tan^{-1}(2x) - \tan^{-1}(y) = -\frac{\pi}{2}$  at  $(-1/2, 1)$  is  
a)  $y = -2x$     b)  $y = -2x + 2$     c)  $y = 2x + 2$     d)  $y = 1/2 - x$   
e)  $y = 3/2 + x$     f)  $y = -3x - 1/2$     g) NP.

8. If the side of a cube is measured to be  $40\text{cm}$  with an error of  $0.01\text{cm}$ , then the error in calculating the volume of the cube is  
a)  $24\text{cm}^3$     b)  $32\text{cm}^3$     c)  $40\text{cm}^3$     d)  $48\text{cm}^3$     e)  $56\text{cm}^3$     f)  $64\text{cm}^3$     g) NP.

9.  $\cos^{-1}\left(\cos\left(\frac{41\pi}{7}\right)\right) =$   
 a)  $\frac{6\pi}{7}$     b)  $\frac{5\pi}{7}$     c)  $\frac{4\pi}{7}$     d)  $\frac{3\pi}{7}$     e)  $\frac{2\pi}{7}$     f)  $\frac{\pi}{7}$     g) NP.
10. If  $f(x) = \frac{\ln(x) - \ln(3)}{\ln(x) - 3\ln(3)}$ , then  $f^{-1}(x)$  is  
 a)  $3^{\frac{x-1}{3x-1}}$     b)  $3^{\frac{3x+1}{x+1}}$     c)  $3^{\frac{x-1}{x+1}}$     d)  $3^{\frac{3x-1}{x-1}}$     e)  $3^{\frac{3x-1}{x+1}}$     f)  $3^{\frac{3x+1}{x-1}}$     g) NP.
11. The derivative of  $\log_{\cos(x^2)}(e)$  is  
 a)  $\frac{2x}{\tan(x^2)\ln^2(\cos(x^2))}$     b)  $\frac{x}{\tan(x^2)\ln^2(\cos(x^2))}$   
 c)  $\frac{2x}{\cot(x^2)\ln^2(\cos(x^2))}$     d)  $\frac{-2x}{\cot(x^2)\ln^2(\cos(x^2))}$     e)  $\frac{2x}{\sin(x^2)\ln(\cos(x^2))}$     f) NP.
12. If a man  $6ft$  tall is walking away from a streetlight at a rate of  $3ft/s$ , and his shadow length is changing at the rate of  $1ft/s$ , then the streetlight length is  
 a)  $12ft$     b)  $16ft$     c)  $18ft$     d)  $24ft$     e)  $30ft$     f)  $36ft$     g) NP.
13. The function  $f(x) = 2e^x - 3x^2 + 3\ln^2(3) - 6$  has at  $x = \ln 3$   
 a) a vertical tangent line    b) a cusp    c) a relative minimum  
 d) an inflection point    e) a relative maximum    f) a critical point    g) NP.
14. The critical points of the function  $f(x) = \frac{1}{x-2} + |x^2 - 6x|$  are  
 a) 0, 2, 6    b) 0, 2, 3, 6    c) 0, 3, 6    d) 0, 6    e) NP.
15. If the position of a particle moving along an  $s$ -axis is given by  $s(t) = t^3 - 3t^2$ , then the distance traveled during the time interval  $[0, 5]$  is  
 a) 34    b) 42    c) 50    d) 54    e) 58    f) NP.
16. If the highest position reached by a projectile launched upward from ground level is  $45m$ , then its initial speed is (take  $g \approx 10m/s^2$ )  
 a)  $5m/s$     b)  $10m/s$     c)  $20m/s$     d)  $30m/s$     e)  $40m/s$     f) NP.
17. If Newton's method is used to approximate  $\sqrt[3]{2}$ , and if  $x_1 = 1$ , then  $x_3$  is equal to  
 a)  $91/72$     b)  $81/73$     c)  $75/64$     d)  $54/47$     e)  $44/35$     f) NP.
18. Find the dimensions of a rectangle with perimeter  $300m$  whose area is as large as possible.

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Each correctly answered question will be given 2 marks. For the first 17 questions, circle the letter before the correct answer. All type of Calculators and Mobiles are not allowed.

1.  $\lim_{x \rightarrow -4} \frac{\sin(x^3 + 5x^2 + 5x + 4)}{\sin(x^2 + 5x + 4)} =$   
a)  $-\infty$     b)  $-13/3$     c)  $-13/2$     d) 0    e)  $13/2$     f)  $13/3$     g)  $+\infty$     h) DNE    i) NP.

2.  $\lim_{x \rightarrow +\infty} \frac{\sin(x^7 - x^5)}{x} \sin\left(\frac{1}{x^6 - x^4}\right) =$   
a)  $-\infty$     b) 0    c) -1    d) 1    e)  $+\infty$     f) DNE    g) NP.

3.  $\lim_{x \rightarrow 0} \frac{\sqrt[3]{18}}{x^2} - \frac{\sin(\sqrt[3]{18}x)}{x^3} =$   
a)  $-\infty$     b) 0    c) 1    d) 3    e)  $+\infty$     f) DNE    g) NP.

4.  $\lim_{x \rightarrow 0} (1 + \tan(4x))^{\frac{1}{\ln(1 + \sin x)}} =$   
a) 1    b)  $\sqrt[4]{e}$     c)  $e$     d)  $e^4$     e)  $+\infty$     f) DNE    g) NP.

5.  $\lim_{x \rightarrow 4} \frac{x^x - 4^4}{(1 + \ln 4)(x - 4)} =$   
a) 0    b) 4    c)  $\ln 4$     d)  $4^4$     e)  $4^{-4}$     f)  $+\infty$     g) DNE    h) NP.

6. The local linear approximation of  $\sqrt[3]{29}$  to 3 decimal places is  
a) 3.068    b) 3.070    c) 3.072    d) 3.074    e) 3.076    f) 3.078    g) NP.

7. An equation of the tangent line to the curve  $\tan^{-1}(3x) - \tan^{-1}(y) = \frac{\pi}{2}$  at  $(1/3, -1)$  is  
a)  $y = -3x$     b)  $y = -2/3 - x$     c)  $y = x - 4/3$     d)  $y = 3x - 2$   
e)  $y = 2x - 5/3$     f)  $y = -2x - 1/3$     g) NP.

8. If the side of a cube is measured to be  $50\text{cm}$  with an error of  $0.01\text{cm}$ , then the error in calculating the volume of the cube is  
a)  $10\text{cm}^3$     b)  $25\text{cm}^3$     c)  $50\text{cm}^3$     d)  $75\text{cm}^3$     e)  $100\text{cm}^3$     f)  $125\text{cm}^3$     g) NP.

9.  $\cos^{-1}\left(\cos\left(\frac{63\pi}{8}\right)\right) =$   
 a)  $\frac{\pi}{8}$     b)  $\frac{\pi}{4}$     c)  $\frac{3\pi}{8}$     d)  $\frac{5\pi}{8}$     e)  $\frac{3\pi}{4}$     f)  $\frac{7\pi}{8}$     g) NP.
10. If  $f(x) = \frac{\ln(x) - \ln(4)}{\ln(x) - 4\ln(4)}$ , then  $f^{-1}(x)$  is  
 a)  $4^{\frac{x-1}{4x-1}}$     b)  $4^{\frac{4x+1}{x+1}}$     c)  $4^{\frac{x-1}{x+1}}$     d)  $4^{\frac{4x-1}{x-1}}$     e)  $4^{\frac{4x-1}{x+1}}$     f)  $4^{\frac{4x+1}{x-1}}$     g) NP.
11. The derivative of  $\log_{\sin(x^3)}(e)$  is  
 a)  $\frac{3x^2}{\cot(x^3)\ln^2(\sin(x^3))}$     b)  $\frac{-3x^2}{\cot(x^3)\ln^2(\sin(x^3))}$   
 c)  $\frac{-1}{\tan(x^3)\ln^2(\sin(x^3))}$     d)  $\frac{3x^2}{\tan(x^3)\ln^2(\sin(x^3))}$     e)  $\frac{-3x^2}{\tan(x^3)\ln^2(\sin(x^3))}$     f) NP.
12. If a man  $6ft$  tall is walking away from a streetlight at a rate of  $4ft/s$ , and his shadow length is changing at the rate of  $1ft/s$ , then the streetlight length is  
 a)  $12ft$     b)  $16ft$     c)  $18ft$     d)  $24ft$     e)  $30ft$     f)  $36ft$     g) NP.
13. The function  $f(x) = 2e^x - 4x^2 + 4\ln^2(4) - 8$  has at  $x = \ln 4$   
 a) a vertical tangent line    b) a cusp    c) a relative minimum  
 d) an inflection point    e) a relative maximum    f) a critical point    g) NP.
14. The critical points of the function  $f(x) = \frac{1}{x-3} + |x^2 - 8x|$  are  
 a) 0, 3, 8    b) 0, 3, 4, 8    c) 0, 4, 8    d) 0, 8    e) NP.
15. If the position of a particle moving along an  $s$ -axis is given by  $s(t) = 3t^2 - t^3$ , then the distance traveled during the time interval  $[0, 4]$  is  
 a) 12    b) 16    c) 20    d) 24    e) 30    f) NP.
16. If the highest position reached by a projectile launched upward from ground level is  $80m$ , then its initial speed is (take  $g \approx 10m/s^2$ )  
 a)  $5m/s$     b)  $10m/s$     c)  $20m/s$     d)  $30m/s$     e)  $40m/s$     f) NP.
17. If Newton's method is used to approximate  $\sqrt[3]{2}$ , and if  $x_1 = 1$ , then  $x_3$  is equal to  
 a)  $44/35$     b)  $54/47$     c)  $75/64$     d)  $81/73$     e)  $91/72$     f) NP.
18. Find the dimensions of a rectangle with perimeter  $400m$  whose area is as large as possible.

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Each correctly answered question will be given 2 marks. For the first 17 questions, circle the letter before the correct answer. All type of Calculators and Mobiles are not allowed.

1.  $\lim_{x \rightarrow -5} \frac{\sin(x^3 + 6x^2 + 6x + 5)}{\sin(x^2 + 6x + 5)} =$   
a)  $-\infty$     b)  $-21/4$     c)  $-21/5$     d) 0    e)  $21/5$     f)  $21/4$     g)  $+\infty$     h) DNE    i) NP.

2.  $\lim_{x \rightarrow +\infty} \frac{\sin(x^8 - x^6)}{x} \sin\left(\frac{1}{x^7 - x^5}\right) =$   
a)  $-\infty$     b) 0    c) -1    d) 1    e)  $+\infty$     f) DNE    g) NP.

3.  $\lim_{x \rightarrow 0} \frac{\sqrt[3]{6}}{x^2} - \frac{\sin(\sqrt[3]{24x})}{x^3} =$   
a)  $-\infty$     b) 0    c) 1    d) 4    e)  $+\infty$     f) DNE    g) NP.

4.  $\lim_{x \rightarrow 0} (1 + \tan(5x))^{\frac{1}{\ln(1 + \sin x)}} =$   
a) 1    b)  $\sqrt[5]{e}$     c)  $e$     d)  $e^5$     e)  $+\infty$     f) DNE    g) NP.

5.  $\lim_{x \rightarrow 5} \frac{x^x - 5^5}{(1 + \ln 5)(x - 5)} =$   
a) 0    b) 5    c)  $\ln 5$     d)  $5^5$     e)  $5^{-5}$     f)  $+\infty$     g) DNE    h) NP.

6. The local linear approximation of  $\sqrt[3]{65}$  to 3 decimal places is  
a) 4.021    b) 4.023    c) 4.025    d) 4.027    e) 4.029    f) 4.031    g) NP.

7. An equation of the tangent line to the curve  $\tan^{-1}(3x) - \tan^{-1}(y) = -\frac{\pi}{2}$  at  $(-1/3, 1)$  is  
a)  $y = -3x$     b)  $y = x + 4/3$     c)  $y = 3x + 2$     d)  $y = 2/3 - x$   
e)  $y = 5/3 + 2x$     f)  $y = -2x + 1/3$     g) NP.

8. If the side of a cube is measured to be  $20\text{cm}$  with an error of  $0.01\text{cm}$ , then the error in calculating the volume of the cube is  
a)  $10\text{cm}^3$     b)  $12\text{cm}^3$     c)  $20\text{cm}^3$     d)  $30\text{cm}^3$     e)  $40\text{cm}^3$     f)  $60\text{cm}^3$     g) NP.

9.  $\cos^{-1}\left(\cos\left(\frac{71\pi}{9}\right)\right) =$   
 a)  $\frac{\pi}{9}$     b)  $\frac{2\pi}{9}$     c)  $\frac{\pi}{3}$     d)  $\frac{4\pi}{9}$     e)  $\frac{5\pi}{9}$     f)  $\frac{8\pi}{9}$     g) NP.
10. If  $f(x) = \frac{\ln(x) - \ln(5)}{\ln(x) - 5\ln(5)}$ , then  $f^{-1}(x)$  is  
 a)  $5^{\frac{x-1}{5x-1}}$     b)  $5^{\frac{5x+1}{x+1}}$     c)  $5^{\frac{x-1}{x+1}}$     d)  $5^{\frac{5x-1}{x-1}}$     e)  $5^{\frac{5x-1}{x+1}}$     f)  $5^{\frac{5x+1}{x-1}}$     g) NP.
11. The derivative of  $\log_{\cos(x^3)}(e)$  is  
 a)  $\frac{3x^2}{\tan(x^3)\ln^2(\cos(x^3))}$     b)  $\frac{3x^2}{\cot(x^3)\ln^2(\cos(x^3))}$   
 c)  $\frac{-1}{\cot(x^3)\ln^2(\cos(x^3))}$     d)  $\frac{-3x^2}{\cot(x^3)\ln^2(\cos(x^3))}$     e)  $\frac{-3x^2}{\sin(x^3)\ln(\cos(x^3))}$     f) NP.
12. If a man  $6ft$  tall is walking away from a streetlight at a rate of  $5ft/s$ , and his shadow length is changing at the rate of  $1ft/s$ , then the streetlight length is  
 a)  $12ft$     b)  $16ft$     c)  $18ft$     d)  $24ft$     e)  $30ft$     f)  $36ft$     g) NP.
13. The function  $f(x) = 2e^x - 5x^2 + 5\ln^2(5) - 10$  has at  $x = \ln 5$   
 a) a vertical tangent line    b) a cusp    c) a relative minimum  
 d) an inflection point    e) a relative maximum    f) a critical point    g) NP.
14. The critical points of the function  $f(x) = \frac{1}{x-4} + |x^2 - 10x|$  are  
 a) 0, 4, 10    b) 0, 4, 5, 10    c) 0, 5, 10    d) 0, 10    e) NP.
15. If the position of a particle moving along an  $s$ -axis is given by  $s(t) = 3t^2 - t^3$ , then the distance traveled during the time interval  $[0, 5]$  is  
 a) 34    b) 42    c) 50    d) 54    e) 58    f) NP.
16. If the highest position reached by a projectile launched upward from ground level is  $125m$ , then its initial speed is (take  $g \approx 10m/s^2$ )  
 a)  $30m/s$     b)  $40m/s$     c)  $50m/s$     d)  $60m/s$     e)  $70m/s$     f) NP.
17. If Newton's method is used to approximate  $\sqrt[3]{2}$ , and if  $x_1 = 1$ , then  $x_3$  is equal to  
 a)  $44/35$     b)  $54/47$     c)  $75/64$     d)  $81/73$     e)  $91/72$     f) NP.
18. Find the dimensions of a rectangle with perimeter  $500m$  whose area is as large as possible.