1. Obtain $\lim_{x\to+\infty} \frac{6+3x-x^3}{2x^3+2x^2+9}$. (a) 3 (b) 2 (c) $-\frac{1}{2}$ (d) $-\frac{1}{3}$

2. Determine $\lim_{x\to+\infty} \frac{2x^2+2x+6}{3x^3+2x+9}$. (a) 0 (b) 1 (c) $\frac{7}{3}$ (d) $\frac{3}{2}$

3. If $sin\theta = \frac{a}{b}$, where θ is an acute angle express $\frac{1}{sin^2\theta} + \frac{1}{cos^2\theta}$ in terms of a and b. (a) $\frac{b}{a^2(b-c)}$ (b) $\frac{b^4}{a^2(b^2-a^2)}$ (c) $\frac{a^2}{b-a}$ (d) $\frac{ba}{a^2}$

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4. State $\frac{sin\frac{\pi}{3}+cos\frac{\pi}{3}}{tan\frac{\pi}{3}}$ in surd form. (a) 3 (b) 7 (c) $\frac{3+\sqrt{3}}{6}$ (d) $\frac{3-\sqrt{3}}{5}$

5. Given that $h(x) = \frac{2x-1}{3-x}$, find the largest domain of $h^{-1}(x)$. (a) $\Re\setminus\{3\}$ (b) $\Re\setminus\{-2\}$ (c) $\Re\setminus\{2\}$ (d) $\Re\setminus\{-3\}$

6. Simplify $cos4\theta$ (a) $8cos\theta - 8sin\theta + 2$ (b) $8cos^4\theta - 8cos^2\theta + 1$ (c) $3cos^4\theta - 2sin^3\theta$ (d) $cos\theta + sin^2\theta$

7. If $f(x) = 3x^2 - 2$ and $g(x) = x + 2$, find x such that $f(g(x)) = g(f(x))$. (a) $-\frac{3}{4}$ (b) $\frac{3}{4}$ (c) $-\frac{4}{3}$ (d) $\frac{4}{3}$

-5/6

8. Given $f(x) = \frac{x^2}{x^2+2}$ and $g(x) = \sqrt{x-2}, x \geq 2$ find the value of x for which $f(g(x))$ is not defined. (a) 0 (b) 1 (c) 2 (d) 3

9. Express 240^o in radians as a multiple of π. (a) 3π (b) $\frac{3\pi}{2}$ (c) $\frac{\pi}{8}$ (d) $\frac{4\pi}{3}$

10. Find the largest domain of $f(x) = \sqrt{9-x^2}$. (a) $x \geq 3$ (b) $-3 \leq x \leq 3$ (c) $x \geq -3$ (d) $x \leq -3$ or $x \geq 3$

11. If $tan\theta = \frac{a}{b}$, where θ is an acute angle find $\frac{acos\theta - bsin\theta}{acos\theta + bsin\theta}$. (a) 0 (b) 5 (c) 6 (d) 1

12. Let the function $f : \Re \to \Re$ be defined by $f(x) = \begin{cases} 4x+7, if & x > 3 \\ x^2-3, if & -2 \leq x \leq 3 \\ 2x+3, if & x < -2 \end{cases}$ .find $f(-1)$.

(a) 2 (b) 1 (c) -1 (d) -2

13. Simplify $\frac{sec\theta}{cos\theta} - \frac{tan\theta}{cot\theta}$. (a) 1 (b) 7 (c) 6 (d) 4

14. Given that $tan\theta = \frac{2t}{1+t^2}$, and that θ is an acute angle, express $sin\theta$ in terms of t. (a) $5t$ (b) $\frac{2t}{1+t^2}$ (c) $2t-4$ (d) $\frac{t}{2}$

15. $2cos5\theta sin2\theta$ equals (a) $sin2\theta - cos\theta$ (b) $sin5\theta + 3sin\theta$ (c) $sin7\theta - sin3\theta$ (d) $sin\theta + sin3\theta$

16. Which of the following is true about the mappings f and g $(f \neq g)$. (a) $(fog)^{-1} = g^{-1}of^{-1}$ (b) $(fog)^{-1} = f^{-1}og^{-1}$ (c) $(fog)^{-1} = fog^{-1}$ (d) $(fog)^{-1} = f^{-1}og$

Find the range of $f(x) = x^2 + 2$. (a) $\{$ (b) $\{$ (c) $\{$ (d) $\{x \in \mathbb{R} : x > 2\}$

Determine $tan\theta$ if $3sec^2\theta = 2tan\theta + 4$

If α and β are two acute angles such that $sin\alpha =$ metrical table,evaluate $tan(\alpha - \beta)$. (a) (b) (c) (d)

A function which is both one-to-one and onto is called (a) (b) (c)
(d) map

S/N	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

S/N	A	B	C	D
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				

UNIVERSITY OF AGRICULTURE ABEOKUTA

Department of Mathematics

2008/2009 Second Semester Examinations

MTS 102: Calculus

Answer All Questions by shading your answers in the objective answer sheet provided

Time Allowed: 2 Hours. Type: B

A curve y is given by

$$y = \frac{1}{\sqrt{4x-3}}$$

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Now answer the next 3 questions

1. Find the relationship between y, $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$.
   (A) $y(4x-3)\frac{d^2y}{dx^2} + \left[(4x-3)\frac{dy}{dx} + 8y\right]\frac{dy}{dx} = 0$ (B) $(4x-3)\frac{d^2y}{dx^2} + x\frac{dy}{dx} + 16y = 0$
   (C) $x\frac{d^2y}{dx^2} + (4x-3)\frac{dy}{dx} + 8y = 0$ (D) $\frac{d^2y}{dx^2} + \left[\frac{dy}{dx}\right]^2 + 16y = 0$

2. What is the value of
$$\frac{\frac{d^2y}{dx^2}}{\sqrt{\left[1+\left[\frac{dy}{dx}\right]^2\right]^3}}$$
when $x = 1$? (A) 0.4 (B) 1.4 (C) 2.4 (D) -2.4

3. Find the value of $p^2 + ab + q^2 - cd$ if $ay + bx = p$ and $cy + dx = q$ are the equations of the tangent and the normal to the curve respectively at the point (1,1). (A) -10 (B) 10 (C) -14 (D) 14

4. If $y = (3x^2 - 4)^3$ and y is increased by 0.5% when $x = 2$, find the approximate percentage change in y. (A) 4% (B) 4.5% (C) 5% (D) 5.5%

5. Let $p = kv^{4/3}$ where k is a constant. What approximate percentage increase in v will cause a 4% increase in p ? (A) 1% (B) 2% (C) 3% (D) 4%

6. The volume of a cube is increasing at the rate of 2 cm^3s^{-1}. Find the rate in cms^{-1} of the change of the side of the base when its length is 3 cm. (A) 2/27 (B) 2/7 (C) 2/9 (D) 2/3

7. The area of a circle is increasing at the rate of 3 cm^2s^{-1}. Find the rate in cms^{-1} of change of the circumference when the radius is 2 cm. (A) 2/3 (B) 3/2 (C) 1/3 (D) 2

8. In the formula $T = 2\pi\sqrt{\frac{l}{g}}$, an error of 1% is incurred in the measurement of T. What will be the percentage error in the calculated value of g ? (A) 1% (B) 2% (C) 3% (D) 4%

9. Let $yx^\alpha = \beta$ where α and β are constants. If δy and δx are corresponding small changes in y and x respectively, find an expression for $\frac{\delta y}{y}$ in terms of α, δx and x. (A) $\alpha\frac{x}{\delta x}$ (B) $-\frac{1}{\alpha}\frac{\delta x}{x}$ (C) $-\alpha\frac{\delta x}{x}$ (D) $\alpha\frac{\delta x}{x}$

10. If $y = \cos^{-1}\left[\frac{1-x^2}{1+x^2}\right]$, find $\frac{dy}{dx}$. (A) $\frac{2}{1+x^2}$ (B) $\frac{-4x}{(1+x^2)^2}$ (C) $\frac{8x}{1+x^2}$ (D) $\frac{-2}{1+x^2}$

11. A particle moving in a straight line covered a distance x after time t. If v is the velocity of the particle and a is its acceleration, which of the following is(are) true of the motion of the particle ?
   (I) $v = \frac{dx}{dt}$
   (II) $a = \frac{dv}{dt}$
   (III) $a = \frac{d^2x}{dt^2}$
   (IV) $a = v\frac{dv}{dx}$
   (V) $x = 0$ when $a = 0$
   (VI) $x = 0$ when $v = 0$.
   (A) I, II and III only (B) All except IV (C) All except V and VI (D) All

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2011/2012 MTS 102 CAT^b, Instruction: Answer all ques
Name: Dept: Ma

1. If $x = \sin y$ and $y = \cos q$, find the value of $\frac{y^4-x^4}{y^2-x^2}$. (a) $1 + \sin^2 p$ (d) $\sin^2 p + \cos^2 q$

2. The secant of an angle is -1.0590 and its cosecant is negative. Find the a between 500^c and 600^c. (a) 539.3^o (b) 549.3^o (c) 559.3^o (d) 599.3^o

3. Given that $\tan 2x = \frac{3}{4}$, find the value of $\tan 3x$. (a) $\frac{5}{0}$ (b) $\frac{7}{9}$ (c) $\frac{11}{9}$ (d) $\frac{13}{0}$

4. Simplify $[\frac{1+\sin x}{1+\cos x}][\frac{1+\sec x}{1+\operatorname{cosec} x}]$. (a) $\sin x$ (b) $\cos x$ (c) $\tan x$ (d) $\cot x$

5. Find x given that $\tan^{-1}(2x+1) - \tan^{-1}(2x-1) = \tan^{-1}\frac{1}{8}$ (a) ± 1 (b) ± 2 (c) ± 3 (d) $\pm$ 4

6. Find the general solution of the equation $\cos \frac{x}{5} = \frac{\sqrt{3}}{2}$. (a) $n\pi \pm \frac{5\pi}{6}$ (b) $10n\pi \pm \frac{5\pi}{6}$ (c) $n\pi$ (d) $10n\pi$

7. Find $\lim_{x\to 0}(x^2 + \frac{\cos 5x}{10,000})$. (a) 0.00010 (b) 0.01000 (c) 0.01000 (d) 0.00001

8. Determine the $\lim_{x\to\infty} \frac{4x^2+2x-1}{3x^2+x-2}$. (a) $\frac{3}{4}$ (b) $\frac{4}{3}$ (c) $\frac{5}{8}$ (d) $\frac{3}{5}$ D'OLA@FUNAABSU001

9. If $f(x) = \frac{x+1}{x^2+x-2}$, find the values of x where the function $f(x)$ will have no images. (a) $1, 2$ (b) $2, -1$ (c) $-2, 1$ (d) $-1, -2$

10. If $\cos x = \frac{15}{17}$, $\sin y = \frac{20}{29}$, where x is reflex and y is obtuse, find the value of $\sin(x+y)$. (a) $\frac{289}{493}$ (b) $\frac{225}{493}$ (c) $-\frac{468}{493}$ (d) $\frac{466}{493}$

11. If $\cos x = \frac{15}{17}$, $\sin y = \frac{20}{29}$, where x is reflex and y is obtuse, find the value of $\cos(x-y)$. (a) $-\frac{400}{841}$ (b) $-\frac{475}{493}$ (c) $-\frac{225}{289}$ (d) $\frac{475}{493}$

12. If $\cos x = \frac{15}{17}$, $\sin y = \frac{20}{29}$, where x is reflex and y is obtuse, find the value of $\cot(x-y)$. (a) $\frac{476}{132}$ (b) $\frac{132}{476}$ (c) $\frac{475}{493}$ (d) $-\frac{475}{132}$

13. If $t = \tan \frac{x}{2}$, express the expression $\sqrt{\frac{1+\sin x}{1-\sin x}}$ in terms of t. (a) $\frac{1+t}{1-t}$ (b) $\frac{1-t}{1+t}$ (c) $\frac{2t}{1-t^2}$ (d) $\frac{2t}{1+t^2}$

14. On what intervals is the function $f(x) = x^{160} - 2x^{37} + 7$ continuous? (a) $[-\infty, \infty]$ (b) $(-\infty, \infty)$ (c) $(-\infty, \infty]$ (d) $[-\infty, \infty)$

15. Find $\lim_{x\to 2}(\frac{3x^2-12}{x-2})$. (a) 10 (b) 8 (c) 12 (d) 14

16. Find $\lim_{n\to\infty}(\frac{3^{n+1}-5^{n+1}}{3^n-5^n})$. (a) 5 (b) 15 (c) 19 (d) 10

17. Find $\lim_{x\to 1}(\frac{4x^2+3x-1}{2x^2+x-2})$ (a) 5 (b) 7 (c) 6 (d) 10

18. If $f(x) = f(-x)$, then $f(x)$ is . (a) an even function (b) an odd function (c) an identity function (d) monotonic function

19. If $g : y \to \sqrt{y+5}$. Determine $f(g(20))$. (a) 24 (b) 27 (c) 16 (d) 25

20. The domain of the function $f(x) = 2^x$ is . (a) The set of positive integers (b) The set of integers (c) The set of complex numbers (d) The set of real numbers

36. Determine the range of the real valued function $f(x) = \frac{2}{4x+1}$
A. $R = \{\frac{1}{4}\}$ B. $R = \{0\}$ C. $\frac{1}{4}$ D. $\{0\}$

37. If a side of a square is increases by 0.5 percent, find the approximate percentage in the area
A. 1 percent B. 2 percent C. 0.5 percent D. 3 percent

38. Find the rate at which the volume of a spherical balloon is increasing if the surface area is increasing at the rate of $6cm^2s^{-1}$ when the radius of the spherical balloon is 5cm.
A. $10cm^2s^{-1}$ B. $15cm^2s^{-1}$ C. $30cm^2s^{-1}$ D. $20cm^2s^{-1}$

39. The motion of a particle along a straight line is specified by the equation $x = 4t^4 - 3t^3$, find the acceleration after 5 seconds.
A. $1111ms^{-2}$ B. $378ms^{-2}$ C. $351ms^{-2}$ D. $1110ms^{-2}$

40. Evaluate $\int \frac{x^2+x+2}{x^2+x+1}dx$
A. $x + \frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$ B. $x - \frac{2}{\sqrt{3}}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$ C. $x - \frac{\sqrt{3}}{2}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$ D. $x + \frac{\sqrt{3}}{2}\tan^{-1}\left(\frac{2x+1}{\sqrt{3}}\right)+c$

41. Evaluate $\int_0^1 \frac{dx}{(2-x)(1+x)}$. A. $\frac{1}{3}\log_e 2$ B. $\log_e 4$ C. $\frac{1}{3}\log_e 3$ D. $\frac{1}{3}\log_e 4$

42. Solve $\frac{dy}{dx} = \frac{2}{x} + \frac{1}{x^2}$ where $y = -1$ when $x = 1$.
A. $y = \log_e x^2 + \frac{1}{x} - 2$ B. $y = 2\log_e x + \frac{1}{x} - 1$ C. $y = 2\log_e x + \frac{1}{x}$ D. $y = \log_e x^2 - \frac{1}{x} + 2$

43. If $y = 3t^3 + 2t^2 - 7t + 3$, find $\frac{dy}{dt}$ at $t = -1$.
A. -1 B. 1 C. -2 D. 2

44. Find the point (x, y) on the Euclidean plane where the curve $y = 2x^2 - 2x + 3$ has 2 as gradient.
A. (1,3) B. (2,7) C. (0,3) D. (3,15)

45. Differentiate $\frac{6x^3 - 5x^2 + 1}{3x^2}$ with respect to x.
A. $2 + \frac{2}{3x^3}$ B. $2 + \frac{1}{6x}$ C. $2 - \frac{2}{3x^3}$ D. $2 - \frac{1}{6x}$

46. $\frac{d}{dx}\cos(3x^2 - 2x)$ is equal to
A. $-\sin(6x-2)$ B. $-\sin(3x^2-2x)$ C. $(6x-2)\sin(3x^2-2x)$ D. $-(6x-2)\sin(3x^2-2x)$

47. If $y = x\sin x$, find $\frac{d^2y}{dx^2}$.
A. $2\cos x - x\sin x$ B. $\sin x + x\sin x$ C. $\sin x - x\cos x$ D. $x\sin x - 2\cos x$

48. Obtain a maximum value of the function $x^3 - 12x + 1$.
A. -5 B. -2 C. 2 D. 27

49. If x is an obtuse angle and $\tan 2x = \frac{5}{12}$, what is the value of $\cos 4x$?
(A) $-\frac{119}{169}$ (B) $\frac{119}{169}$ (C) $\frac{24}{25}$ (D) $-\frac{12}{13}$

50. Given that $\tan(x+y) = 1$ and $\tan(x-y) = \frac{1}{7}$, what is the value of $(\tan x, \tan y)$ if x and y are acute ?
(A) (1/2,1/3) (B) (2,3) (C) (1/3,1/2) (D) (3,2)

51. If x is an acute angle such that $\sin x = 3/5$ and y is an obtuse angle such that $\cos y = -5/13$, find the value of $\sin y + \sin x\cos(x+y) + \cos x\sin(x-y)$.
(A) 21/65 (B) -24/25 (C) 144/169 (D) -24/65

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52. Find the value of $\sin 345°$ in surd form
(A) $1/4(\sqrt{2}-\sqrt{3})$ (B) $1/4(\sqrt{2}-\sqrt{5})$ (C) $1/4(\sqrt{2}-\sqrt{6})$ (D) $1/4(\sqrt{6}-\sqrt{2})$

53. In radian measure, 720° is equivalent to
(A) π (B) 2πrad (C) 3π (D) 4πrad

12. Determine the point of discontinuity in $f(x) = \frac{x+3}{x^2+6x+9}$

(a) 3 (b) -3 (c) 0 (d) none

13. Evaluate the integral $\int (x^3 - 2)dx$

(a) $\frac{x^4}{4} - 2x + c$ (b) $\frac{x^4}{4} + 2x + c$ (c) $-\frac{x^4}{4} - 2x + c$ (d) $\frac{x^4}{4} - 2x - c$

14. Evaluate the integral $\int (3x+2)^4 dx$

(a) $\frac{(3x-2)^5}{15} + c$ (b) $\frac{(3x-2)^5}{5} + c$ (c) $\frac{(3x+2)^5}{15} + c$ (d) $\frac{(3x+2)^5}{5} + c$

15. Determine the area bounded by the curve $y = e^x$, at $x = -2$ and $x = 3$

(a) 18.95 units (b) -18.95 units (c) 19.95 units (d) -19.95 units

16. Evaluate $\lim_{x \to 2} \frac{3x^2 - 12}{x - 2}$. (a) 12 (b) −12 (c) -6 (d) 6

17. Find $\lim_{x \to \infty} \frac{4x^2 + 2x - 1}{3x^2 + x - 2}$. (a) $\frac{3}{4}$ (b) $-\frac{4}{3}$ (c) $\sqrt[3]{4}$ (d) $\sqrt{3}$

18. Find $\lim_{x \to -2} \frac{x^3 + 8}{x^2 - 4}$. (a) −2 (b) −3 (c) 4 (d) 1

19. Let the mappings f and g on the set of real numbers be define by $f(x) = 2x^2 - 3$ and $g(x) = x + 1$. Find gof (a) $2x^2 + 4x - 1$ (b) $2x^2 - 4x + 1$ (c) $2x^2 - 2$ (d) $2x^2 + 2$

20. Given that $y = x^2 Cos 2x$, find the values of $\frac{dy}{dx}$ and $\frac{d^2y}{dx^2}$, when $x = \frac{\pi}{2}$

(a) $-\pi, \pi^2 - 2$ (b) $-\pi, \pi^2 + 2$ (c) $\pi, \pi^2 - 2$ (d) $\pi, 2$ (e) $\pi, \pi^2 + 2$

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NAME----------MATRIC/NO----------DEPT----------

1	A	B	C	D	11	A	B	C	D
2	A	B	C	D	12	A	B	C	D
3	A	B	C	D	13	A	B	C	D
4	A	B	C	D	14	A	B	C	D
5	A	B	C	D	15	A	B	C	D
6	A	B	C	D	16	A	B	C	D
7	A	B	C	D	17	A	B	C	D
8	A	B	C	D	18	A	B	C	D
9	A	B	C	D	19	A	B	C	D
10	A	B	C	D	20	A	B	C	D

44. If f and g are functions defined over the set of real numbers by $f(x) = x + 2$ and $g(x) = 2x^2 + 1$ respectively. The value of x for which $f \circ g = g \circ f$ is
A. $\frac{-3}{4}$ B. $\frac{3}{4}$ C. $\frac{-7}{4}$ D. $\frac{7}{4}$

45. Determine the constants in the function $f(x) = ax^3 + bx^2$ a and b are constants, so that $f'(1) = 5$ and $f''(2) = 32$. Write your answer as (a,b).
A. (-3,2) B. (-2,-3) C. (3,-2) D. (-2,3).

46. The function $f(x) = ax^2 + bx + c$ is defined on the set of real numbers is such that $f(0) = -4, f(1) = 1$ and $f(-1) = -5$, a, b and c are respectively
A. -4,3,2 B. 2,-3,-4 C. 3,2,-4 D. 2,3,-4.

Use this information to answer the next three questions.
Let $f, g : \Re \to \Re$ be define as $f(x) = \sqrt{4 - x^2}$ and $g(x) = \sqrt{x - 1}$, then

47. Domain of f is
A. $\{x \in \Re : -2 \leq x < \infty\}$ B. $\{x \in \Re : 1 \leq x < \infty\}$ C. $\{x \in \Re : -2 \leq x \leq 4\}$ D. $\{x \in \Re : -2 \leq x \leq 2\}$

48. Domain of g is
A. $\{x \in \Re : 1 \leq x < \infty\}$ B. $\{x \in \Re : -\infty \leq x < \infty\}$ C. $\{x \in \Re : 1 \leq x \leq 2\}$ D. $\{x \in \Re : -1 \leq x \leq 1\}$

49. Domain of $f + g$ is
A. $\{x \in \Re : -1 \leq x \leq 1\}$ B. $\{x \in \Re : -2 \leq x \leq 2\}$ C. $\{x \in \Re : 1 \leq x \leq 2\}$ D. $\{x \in \Re : 1 \leq x < \infty\}$

$\int_1 \frac{dx}{\sqrt{4-x^2}}$ is A. $\frac{\pi}{3}$ B. $\frac{2\pi}{3}$ C. $\frac{4\pi}{3}$ D. $\frac{3\pi}{2}$

Dept:

1. Determine the constants in the function $f(x) = ax^3 + bx^2$, a and b are constants, so that $f(1) = 5$ and $f'(2) = 32$. Write your answer as (a,b)
(a). (-3,2) (b). (-2,3) (c). (3,-2) (d) (-2,3)

2. Find $\frac{d}{dx}\cos^{-1}\left[\frac{1-x^2}{1+x^2}\right]$ (a). $\frac{1}{1-x^2}$ (b). $\frac{2}{1+x^2}$ (c). $\frac{2x}{1+x^2}$ (d). $\frac{2}{1-x^2}$

3. Find $\frac{dy}{dx}$ if $y = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$ (a). $\frac{2}{1-x^2}$ (b). $\frac{1}{1-x^2}$ (c). $\frac{2}{1+x^2}$ (c). $\frac{2}{4+x^2}$

4. If $f(x) = 2x + 4$ and $g(x) = 1$, then $(f \circ g)(x)$ and $(f \circ g)(x)$ are respectively. (a) 6,1 (b) 1,6 (c) 2x+4 (d) 2x

5. If $y = 0^n$, where n is a positive integer, then $0^n\frac{d^n y}{dx^n}$ is
(a). ny (b) $n(n-1)y$ (c) ny^2 (d) $n(n+1)y^2$

6. If $y = \tan\theta$, then $\frac{d^2y}{dx^2}$ is. (a) $2y(1-y^2)$ (b) $y(2y-1)$ (c) $1 + y^2$ (d) $2y^2+1$.

7. If $f(x) = \sqrt{4 - x^2}$ and $g(x) = \sqrt{x - 1}$, then Domain of $f + g$ is
(a) $[-1,1]$ (b) $[-2,2]$ (c) $[1,2]$ (d) $[1,\infty]$

8. Find $\frac{dy}{dx}$ if $y = f(x) = 6u + 8$ and $u = g(x) = -5 + 10$

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(a) -30 (b) $\frac{-3}{8}$ (c) 30 (d) $\frac{-6}{5}$

9. $\int 7e^{-7x}\,dx$ is (a). $e^{-7x} + C$ (b). $-e^{-7x} + C$ (c). $\frac{e^{-7x}}{-7} + C$ (d). $-\frac{e^{-7x}}{7} + C$

10. $\int \sin^2 x\,dx$ (a). $\frac{x}{2} - \frac{\sin 2x}{4} + C$ (b). $\frac{1}{2}(x + \sin 2x) + C$ (c). $\frac{1}{2}(x - \frac{\sin 2x}{2}) + C$ (d) $\frac{1}{2}(x - \frac{\sin 2x}{2}) + C$

11. Find $\int \frac{3}{(x+1)(x-2)}\,dx$

(a). $3\ln\left(\frac{x-2}{x+1}\right) + C$ (b). $\frac{1}{3}\ln\left(\frac{x-1}{x+2}\right) + C$ (c). $9\ln\left(\frac{x+2}{x-3}\right) + C$ (d). $3\ln\left(\frac{x+2}{x+1}\right) + C$

12. If $f(x) = \frac{1}{2x}$, then $f(\frac{2x+6}{x+6})$ is (a). $\frac{11}{22}$ (b). $\frac{29}{11}$ (c). $\frac{17}{22}$ (d). $\frac{21}{29}$

13. The equation of the line with slope $\frac{-2}{3}$, through the point (-3,4) is

(a). $3y - 2x - 6 = 0$ (b). $3y - 2x + 6 = 0$ (c). $3y + 2x - 6 = 0$ (d). $-3y - 2x + 6 = 0$

14. Find the equation of a circle passing the points (0,0), (3,1) and (5,5)

(a). $x^2 + y^2 + 10y = 0$ (b). $x^2 + y^2 - 10y = 0$ (c). $x^2 - y^2 - 10y = 0$ (d). $x^2 - y^2 + 10 = 0$

15. Find the area bounded by the curve with the parametric equations $x = at^2$ and $y = 2at$ with the ordinates at $t = 1$ and $t = 2$. (a). $\frac{28a^2}{9}$ (b). $\frac{28a}{9}$ (c). $\frac{28a^2}{3}$ (d). $\frac{28a}{3}$

16. The gradient at the point (1,1) of the tangent to the curve $x^2 + y^2 - 3x + 4y - 3 = 0$

(a). 5 (b). 6 (c). $\frac{1}{6}$ (d). $\frac{3}{4}$

$\frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$

17. Given a function $f(x)$, whose $\frac{df}{dx} = 0$ at the point (x_1, y_1) and $\frac{d^2f}{dx^2} < 0$ at (x_1, y_1), then the point (x_1, y_1) is a ...

(a) minima (b) maxima (c) inflexion (d) saddle

18. If $y = 3x^3 + 2x^2 - 7x - 10$, find $\frac{dy}{dx}$ at $x = 1$

$9x^2 + 4x - 7$

$9 - 4 - 1 = 05 - 1 = -2$

(a) -1 (b) 1 (c) -2 (d) 2

19. Find the equation of the curve whose gradient is $1 - 2x^2$ and which passes through the point $x = 0, y = 1$

(a). $y = x - \frac{2}{3}x^3$ (b). $y = 1 + x - \frac{2}{3}x^3$ (c). $y = 1 + x - x^3$ (d). $y = x - \frac{2}{3}x^3 - 1$

20. Given the parametric equations of the curve with $x = 3t^2$, $y = 3t - t^3$. Find the volume generated when the pla is bounded by the curve with ordinates at $t = 0$ and $t = 2$,

(a). 15.6units^3 (b). 1.56 units^3 (c). -156 units^3 (d).156 units^3

21. The distance between the centres of the circles $x^2 + y^2 + 8x + 10y - 4 = 0$ and $x^2 + y^2 - 2x - 4 = 0$ is

(a). $\sqrt{45}$ (b). $\sqrt{50}$ (c). 45 (d). 5

22. Evaluate $\int (2x + 1)^{\frac{3}{2}} dx$

(a). $\frac{1}{5}(2x + 1)^{\frac{5}{2}} + C$ (b). $\frac{1}{4}(2x + 1)^{\frac{5}{2}} + C$ (c). $\frac{1}{5}(2x + 1)^{\frac{5}{2}} + C$ (d). $\frac{1}{4}(2x + 1)^{\frac{3}{2}} + C$

23. $\int_1^{\frac{1}{2}} \frac{dx}{\sqrt{1-x^2}}$ is (a). $\frac{\pi}{6}$ (b). $\frac{5\pi}{3}$ (c). $\frac{\pi}{6}$ (d). $\frac{5\pi}{2}$

24. Evaluate $\int \frac{\cos x}{1 - \sin x} dx$ (a). $-\log_e \cos x + C$ (b). $\log_e(1 - \sin x) + C$ (c). $-\log_e(1 - \sin x) + C$ (d). $\log_e \cos x + C$

25. $\lim_{x \to 0} \frac{2\sin x - \sin 2x}{x - \sin x}$ is (a). 1 (b). 0 (c). 2 (d). ∞

$\frac{6\cos\theta - 2\sin 2\theta}{\cos\theta + \cos\theta} = \frac{-2\sin 3\theta \cos 2\theta}{2\cos 3\theta \cos 2\theta} = \tan 3\theta$

26. Simplify $\frac{\sin\theta + \sin 2\theta}{\cos\theta + \cos 2\theta}$ (a). $\sin 3\theta$ (b). $\cos 3\theta$ (c). $\tan 3\theta$ (d). $\sec 3\theta$

27. $\int \frac{2x}{(x^2 - 3)(x^2 + 6)} dx$ is (a). $\frac{1}{3}\ln(x^2 + 2x)$ (b). $\ln(x^3 + 3x^2 + 6)$ (c). $\frac{1}{3}\ln(x^3 + 3x^2 + 6)$ (d). $\frac{1}{3}\ln x^2 + \ln 3x + 2$

28. A particle starts with an initial speed of $20ms^{-1}$. Its acceleration at any time t is $(18 - 2t)ms^{-2}$. Find the speed the end of 6 seconds. (a). $72ms^{-1}$ (b). $36ms^{-1}$ (c). $6ms^{-1}$ (d). $92ms^{-1}$

29. The expression $\frac{\sin x - \sin 2x + \sin 3x}{\cos x - \cos 2x + \cos 3x}$

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(a). $\cot 2x$ (b). $\sec 2x$ (c). $\tan 2x$ (d). $\tan^2 2x$

30. Integrate $\sin^3 x \cos^8 x$ with respect to x

(a). $\frac{3}{11}\cos^{11} x + \frac{1}{9}\cos^9 x + C$ (b). $\frac{1}{11}\sin^{11} x - \frac{1}{9}\sin^9 x + C$ (c). $\frac{1}{11}\sin^{11} x + \frac{1}{9}\sin^9 x + C$ (d). $\frac{3}{11}\cos^{11} x - \frac{1}{9}\cos^9 x$

MTS 102 Calculus and Trigonometry **Tutorial Questions.**

1. Express in terms of the trigonometrical ratios of acute angles:
(i.) Sin 170^0 (ii.) Cos 164^0 (iii.) Cos 293^0 (iv.) tan 300^0 (v) Csc 230^0 (vi) Sin(-230^0);
(vii) Cos 200^0 (viii) tan 143^0 (ix) Sec 142^0 (x) Sin (-50^0) (xi) Cos(-130^0) (xii) tan 300
(xiii) Cot 156^0 (xiv) Cos(-20^0) (xv) Sin 250^0 (xvi) Csc (-53^0) (xvii) Sin 325^0 (xviii) Cot
(xix) Sec (172^0) (xx) tan (-140^0) (xxi) Cot 200^0

2. i. If Sin $(x - \alpha)$ = Cos $(x + \alpha)$, prove that tan $x = 1$
ii. Find the value of x if Sin $3x$ = Cos $(2x - 15^0)$.
iii. Find the value of x, if Cos x = Sin $(2x - 20^0)$.
iv. If Cos A = 4/5, Sin B = 8/17, find without using tables, the values of Cos $(A \pm B)$ and Sin $(A \pm B)$.
v. Assuming the formulae for Sin $(A + B)$ and Cos $(A + B)$, prove that

$$\text{Tan}(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

and deduce that if tanα = 1/5, tanβ = 4/19 and tanγ = 2/5 then tan$(\alpha + \beta + \gamma) = 1$

3. i. If A, B and C are angles of a triangle, show that
tan A + tan B + tan C = tan A tan B tan C.
ii. Prove that $\text{Sin}^2\alpha + \text{Sin}^2\beta + 2\text{Sin}\alpha\,\text{Sin}\beta\,\text{Cos}(\alpha + \beta) = \text{Sin}^2(\alpha + \beta)$
iii. Show that Sin$(A + B)$ Sin$(A - B)$ = $\text{Sin}^2 A - \text{Sin}^2 B$.
iv Evaluate Sin 15^0 and Cos 15^0 in terms of $\sqrt{2}$, $\sqrt{3}$.
v Without using tables, find the value of tan 75^0.
vi. Show that tan A + tan B = $\frac{\text{Sin}(A + B)}{\text{Cos}A\,\text{Cos}B}$
vii. Show that. $(\text{Cos}\,\theta + \text{Cos}\,\phi)^2 + (\text{Sin}\,\theta + \text{Sin}\,\phi)^2 = 2 + 2\,\text{Cos}(\theta - \phi)$.

4. Show that;
i. Sin $3A$ = 3 Sin$A$ – 4 $\text{Sin}^3 A$.
ii. $\tan 3A = \frac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$
iii. $\frac{\text{Sin}\theta + \text{Sin}3\theta}{\text{Cos}\theta + \text{Cos}3\theta} = \tan 3\theta$
iv. If Sinθ + Cos ϕ = a and Cosθ + Cosϕ = b, then; $\text{Cos}^2 \frac{1}{2}(\theta - \phi) = \frac{1}{2}(a^2 + b^2)$

$\frac{\text{Sin A Sin 2A}}{\text{Sin A Cos 2A}} = \tan 5A$

Sin C = 4 Cos $A/2$ Cos $B/2$ Cos $C/2$ where A + B + C = 180^0.
Cot C Cot A + Cot A Cot B = 1, where $A + B + C = 180^0$

triangle ABC; (i) Sin $\frac{1}{2}A$ = Cos $\frac{1}{2}(B + C)$ (ii) Cos $\frac{1}{2}B$ = Sin