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) $\frac{2}{3}$ (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° 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) $(fog)^{-1} = f^{-1}og$

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Find the range of $f(x) = x^2 + 2$. (a) [illegible] (b) [illegible] $\{x \in \Re : x > 2\}$ (d) $\{x \in \Re$ [illegible]

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

If α and β are two acute angles such that $sin\alpha = \frac{1}{2}$ [illegible] metrical table,evaluate $tan(\alpha - \beta)$. (a) $\frac{16}{63}$ (b) $\frac{16}{65}$ (c) $\frac{7}{16}$ (d) $\frac{4}{5}$

A function which is both one-to-one and onto is called (a) [illegible] (b) [illegible] (c) [illegible] (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				

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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

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

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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Federal University of Agriculture, Abeokuta, Departme
2011/2012 MTS 102 CAT^b, Instruction: Answer all quest
Name: Dept: Ma

1. If $x = \sin p$ 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 -1.0596 and its cosecant is negative. Find the a between 500° and 600°. (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) $\frac{5}{9}$ (b) $\frac{7}{9}$ (c) $\frac{11}{9}$ (d) $\frac{13}{9}$

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) $\frac{5}{3}$ (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 ... $) = f(-x)$, then $f(x)$ is . (a) an even function (b) an odd function ction (d) monotonic function

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

ction $f(x) = 2^x$ is . (a) The set of positive integers (b) The set set of complex numbers (d) The set of real numbers

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36. Determine the range of the real valued function $f(x) = \frac{2}{4x+1}$
A. $\mathbb{R} - \{\frac{1}{4}\}$ B. $\mathbb{R} - \{0\}$ 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 $\frac{6x^3 - 5x^2 + 1}{3x^3}$ 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

52. Find the value of $\sin 345^o$ 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

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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 $f, g : \Re \rightarrow \Re$ 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. $\frac{3\pi}{2}$

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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 $\frac{d}{dx}\cot^{-1}\left[\frac{1-x^2}{1+x^2}\right]$ (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). $\frac{2}{1+x^2}$

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 $0^n\frac{d^2y}{dx^2}$ 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 $u = g(x) = -5 + 10$.
(a) -30 (b) $\frac{-3}{6}$ (c) 30 (d) $\frac{-6}{3}$

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). $\frac{x}{2}(x + \sin 2x) + C$ (c). $\frac{x}{2}(x - \frac{\sin 2x}{2}) + C$ (d) $\frac{x}{2}(x - \frac{\sin 2x}{2}) + C$

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

12. If $f(x) = \frac{x}{x^2}$, then $f(\frac{2x}{x+6})$ is (a). $\frac{x}{x}$ (b). $\frac{x}{x}$ (c). $\frac{x}{x}$ (d). $\frac{x}{x}$

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). $\frac{3}{4}$

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

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17. Given a function $f(x)$, whose $\frac{df}{dx} = 0$ at the point (x_0, y_0) and $\frac{d^2f}{dx^2} < 0$ at (x_0, y_0), then the point (x_0, y_0) is a ...

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

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

$9x^2 + 4x - 7$

$9 - 4 - 1 = 05 - 7 = -2$

(a). 1 (b). 4 (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 $x = 3t^2$, $y = 3t - t^2$. 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). $\frac{2}{5}(2x + 1)^{\frac{5}{2}} + C$ (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). $\frac{4\pi}{6}$ (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. $\lim_{x \to 0} \frac{2\cos x - 2}{x \sin x}$ is (a). 1 (b). 0 (c). 2 (d). ∞

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). $\sec 3\theta$

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

27. $\int \frac{x^2 - 2x}{x^3 - 3x^2 + 6} dx$ 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 $\frac{\sin x - \sin 2x + \sin 3x}{\cos x - \cos 2x + \cos 3x}$

(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). $\frac{1}{11}\cos^{11} x + \frac{1}{9}\cos^9 x + C$ (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). $\frac{1}{11}\cos^{11} x - \frac{1}{9}\cos^9 x$

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University of Agriculture, Abeokuta.

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 $\tan\alpha = 1/5$, $\tan\beta = 4/19$ and $\tan\gamma = 2/5$ 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 $\text{Sin}(A + B)\,\text{Sin}(A - B) = \text{Sin}^2 A - \text{Sin}^2 B$.
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 $\tan A + \tan B = \dfrac{\text{Sin}(A + B)}{\text{Cos}A\,\text{Cos}B}$
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. $\text{Sin}\,3A = 3\,\text{Sin}A - 4\,\text{Sin}^3 A$.

ii. $\tan 3A = \dfrac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$

iii. $\dfrac{\text{Sin}\theta + \text{Sin}\,5\theta}{\text{Cos}\theta + \text{Cos}5\theta} = \tan 3\theta$

iv. If $\text{Sin}\theta + \text{Cos}\,\phi = a$ and $\text{Cos}\theta + \text{Cos}\phi = b$, then; $\text{Cos}^2\frac{1}{2}(\theta - \phi) = \frac{1}{2}(a^2 + b^2)$

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

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 $\frac{1}{2}B$ = Si

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