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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY, KUMASI  
COLLEGE OF AGRICULTURAL & NATURAL RESOURCES

B.Sc. Agricultural Science (All programmes) First Semester Examinations, 2015

MATH 157: ALGEBRA

FIRST YEAR

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DURATION: 2HRS 30 MINS

INDEX NUMBER: .....

PROGRAMME: .....

INSTRUCTIONS TO CANDIDATES

- Answer all questions in SECTION A.
- In SECTION A, circle the correct answer on the question paper and shade the corresponding on the scannable sheet provided.
- In SECTION B answer one question in the Answer Booklet provided.
- Do not take any sheet out of the examination hall.

AKOSAH  
BRIMPONG  
EMMANUEL

# SECTION A

$$\log_6 x - \log_3 3$$

13. Solve  
A.

- \* 1. Solve  $\log_b X - \log_b 3$  for  $x > 0$   
A.  $x = 21$       B.  $x = 10$       C.  $x = \frac{7}{3}$       D.  $\frac{3}{7}$       E.  $\frac{10}{7}$
2. Evaluate  $\log_5 2 + \log_5 50 - \log_5 4$   
(A) 2      B. 5      C. 25      D. 1      E.  $\sqrt{21}$
3. Given that  $x = \log_5 3 + \log_5 4$ , find  $x$ .  
A.  $\log 12$       B.  $\log 5$       (C) 1.54      D. 2.4      E. 3.47
4. Find  $x$  if  $4 \log_x 6 - 2 \log_x 4 = 1$   
A. 16      B. 4      C. 1.296      (D) 81      E.  $27\sqrt{6}$
5. Solve the equation  $\log_{10}(x^2 - 3) - \log_{10} x = \log_{10} 2$   
A. 3      (B) -1      C. 1      D. 4      E. -3
6. Solve the equation  $\log(x - 1) + \log(x + 8) = 2 \log(x + 2)$   
A. 3      B. 2      C. 1      (D) 4      E. -4
7. Solve the equation  $2^{x+1} = 3^{2x-5}$   
A. 2.69      (B) 4.11      C. 0.65      D. 0.95      E. 1.36
8. Which of the following values is the value of  $x$  if  $6^{2x-1} = 36^{-x}$ ?  
A. -4      B.  $\frac{1}{3}$       (C)  $\frac{1}{4}$       D. 4      E.  $\frac{2}{3}$
9. Find  $x$ , if  $3^{x+2} - 3^{x+1} = \frac{2}{3}$   
A.  $\frac{1}{6}$       B. 2      C.  $\frac{1}{9}$       (D) -2      E. None of these
- \* 10. Solve for  $x$   
A. 3      B. 12      C. 4      D. 20      E. 1
11. Solve for  $x$ , if  $27^{2x-5} = \frac{1}{\sqrt{9x+1}}$   
A. 14      (B) 2      C. 7      D.  $\sqrt{7}$       E. 5
- \* 12. Solve for  $x$ , if  $\frac{16 \cdot 4^{2x+1}}{4^x \cdot 32^{x-1}} = \frac{1}{2^{x-10}}$   
A.  $-\frac{1}{3}$       B.  $\frac{1}{3}$       C. 1      D. 2      E. 3

$$(x+1) \ln(2) = (2x-5) \ln(3)$$

$$\ln 2x + \ln 2 = 2 \ln(3)x - 5 \ln 3$$

$$\frac{\ln(2) + 5 \ln(3)}{2 \ln(3) - \ln(2)}$$

# AKOSAH

13. Solve the equation  $\frac{81^{3x}}{3^{x+2}} = \frac{9^{x-2}}{729}$

A.  $\frac{4}{9}$

B.  $\frac{8}{9}$

C.  $\frac{8}{11}$

☒ D.  $-\frac{8}{9}$

E.  $-\frac{8}{11}$

14.  $\frac{3^n + 3^n + 3^n}{81^n} = \frac{1}{243}$

☒ A. 2

B. -2

C. 1

D. 3

E. -1

15. Find the 15<sup>th</sup> term of the series 3, 9, 15, 21, ... 27 33 39 45 51 57 63 69 75 81 87

A. 78

B. 84

☒ C. 87

D. 81

E. 76

16. The 6<sup>th</sup> term of an Arithmetic Progressions is 7 and 13<sup>th</sup> term is 38. Determine the 19<sup>th</sup> term.

A. 56

B. 2

C. 54

D. 19

E. 3

17. Determine the number of the term whose value is 22 in the series 2.5, 4, 5.5, 7, ...

A. 13

☒ B. 14

C. 15

D. 16

E. 17

18. Find the sum of first 12 terms of the series 5, 9, 13, 17, ...

A. 44

B. 10

☒ C. 324

D. 648

E. 6

19. The sum of 7 terms of an Arithmetic Progression is 35 and the common difference is 1.2. Determine the first term of the series?

A. 7.2

B. 10

C. 2.8

D. 35

☒ E. 1.4

20. Find the sum of the first 9 terms of the series 72.0, 57.6, 46.08, ....

☒ A. 311.7

B. 72

C. 389.6

D. 546.5

E. 472.3

21. Determine the 10<sup>th</sup> term of the series 3, 6, 12, 24, ....

A. 512

B. 1024

☒ C. 3072

D. 3

E. 1536

22. The first term geometric progression is 12 and the fifth term is 55. Determine the 11<sup>th</sup> term.

A. 1.64

B. 172.3

☒ C. 539.7

D. 11.64

E. 593.7

23. In the expansion  $(a - 2b)^3$ , the coefficient of  $b^3$  is

A.  $2a^3$

B.  $-4a$

C.  $-8a$

D.  $12a$

E.  $15a$

☒ F.  $-8$

24. Write down the first three terms of  $(2 - 3x)^5$  in ascending powers of  $x$ .
- A.  $32 + 240x - 720x^2$  B.  $32 - 240x + 720x^2$   
 C.  $32 + 240x + 720x^2$  D.  $32 - 240x - 720x^2$  (E) None of these

25. Find the constant term in expansion  $(2x + \frac{1}{x^2})^3$
- A. 12 B. 8 C. 6 (D) 4 E. 10

26. The partial fraction  $\frac{2}{(x+1)(x-1)} \equiv \frac{A}{x+1} + \frac{B}{x-1}$ , find  $2A + B$
- A. 3 (B) -1 C. 4 D. 1 E. 2

27. Construct an equation with roots  $\sqrt{5} + 2, \sqrt{5} - 2$
- (A)  $x^2 - 2\sqrt{5}x + 1$  B.  $x^2 + 2\sqrt{5}x + 1$   
 C.  $x^2 - 2\sqrt{5}x - 1$  D.  $x^2 - 5\sqrt{2}x + 1$  E. None of these

28. If  $\alpha, \beta$  are the roots of the equation  $3x^2 - x - 5 = 0$ , form the equation whose roots are  $2\alpha - \frac{1}{\beta}, 2\beta - \frac{1}{\alpha}$
- A.  $15x^2 + 13x - 169 = 0$  B.  $15x^2 - 6x - 169 = 0$   
 (C)  $15x^2 - 13x - 169 = 0$  D.  $15x^2 - 6x + 169 = 0$   
 E.  $15x^2 - 13x + 169 = 0$

- \* 29. One root of the equation  $2x^2 + bx + c = 0$  is three times the other root. Which of the following is true?
- A.  $3b = 32c$  B.  $3b^2 = 16c$  C.  $b^2 = 32c$  D.  $9b^2 = 32c$  E.  $3b^2 = 32c$

30. What is the size of the matrix  $A = \begin{bmatrix} 1 & 2 & 3 & 4 \\ 12 & 3 & 4 & 1 \\ 13 & 14 & 1 & 2 \end{bmatrix}$

- A.  $2 \times 3$  B.  $3 \times 2$  C.  $4 \times 3$  D.  $3 \times 3$  (E)  $3 \times 4$

31. What is the size of the matrix product  $\begin{bmatrix} 1 & -11 & 2 \\ 0 & 7 & 0 \\ -3 & 4 & 9 \\ 2 & 3 & 0 \end{bmatrix} \begin{bmatrix} 4 & 0 & 0 \\ 0 & 1 & 5 \\ 3 & 2 & -1 \end{bmatrix}$

- A.  $3 \times 4$  B.  $4 \times 4$  (C)  $4 \times 3$  D.  $3 \times 3$  E. Not possible

# AKOSAH

32. What value of  $x$  satisfies the matrix equation

$$\begin{bmatrix} 0 & -x \\ 3x-2 & 5 \end{bmatrix} = \begin{bmatrix} 0 & 7x+14 \\ x+8 & 5 \end{bmatrix}^T$$

- A.  $x = 4$       **(B)  $x = -4$**       C.  $x = 5$       D.  $x = -2$       E.  $x = 1$

33. Solve for  $x$  and  $y$  in the matrix equation below

$$\begin{bmatrix} 3 & -4 & y \\ 1 & 2 & -1 \end{bmatrix} + \begin{bmatrix} x-y & 4 & 2 \\ 4 & x & -8 \end{bmatrix} = \begin{bmatrix} 10 & 3 & -1 \\ 2 & 6x & -9 \end{bmatrix} \quad \begin{bmatrix} 4 & 3 & -1 \\ -3 & 3x & 0 \end{bmatrix}$$


- A.  $(x, y) = (-1, -2)$       B.  $(x, y) = (1, 2)$   
 C.  $(x, y) = (-2, 1)$       D.  $(x, y) = (-1, 2)$       E.  $(x, y) = (-2, -1)$

34. For matrices  $A = \begin{bmatrix} 2 & -3 \\ 0 & 2 \\ 7 & -2 \end{bmatrix}$  and  $B = \begin{bmatrix} 1 & -2 & 0 \\ 5 & 1 & 2 \end{bmatrix}$

Which of the following is the matrix,  $3(A^T + 2B)$ ?

- (A)  $\begin{bmatrix} 12 & -12 & 21 \\ 21 & 12 & 6 \end{bmatrix}$**       B.  $\begin{bmatrix} 12 & 12 & 21 \\ 21 & -12 & -6 \end{bmatrix}$   
 C.  $\begin{bmatrix} 4 & 7 \\ -4 & 4 \\ 7 & 2 \end{bmatrix}$       D. this matrix is undefined      E.  $\begin{bmatrix} 12 & 21 \\ 12 & -12 \\ 21 & -6 \end{bmatrix}$

35. Which of the following is the matrix product  $\begin{bmatrix} 3 & -1 \\ 0 & 4 \\ 1 & 6 \end{bmatrix} \begin{bmatrix} 1 & 3 & 6 & 0 \\ -2 & 1 & 0 & 1 \end{bmatrix}$

- (A)  $\begin{bmatrix} 5 & 8 & 18 & 1 \\ -8 & 4 & 0 & 4 \\ -11 & 9 & 6 & 6 \end{bmatrix}$**       B.  $\begin{bmatrix} 5 & 8 & 2 & -3 \\ -8 & 0 & 4 & 0 \\ 11 & 6 & 9 & 6 \end{bmatrix}$   
 C.  $\begin{bmatrix} 5 & 18 \\ -11 & 6 \end{bmatrix}$       D.  $\begin{bmatrix} 15 & 18 & 8 & -1 \\ -8 & 4 & 0 & 4 \\ -11 & 9 & 6 & 6 \end{bmatrix}$       E.  The matrix is undefined.

If  $\cos C = \frac{1}{\sqrt{5}}$  and  $C$  is acute, answer questions 36-38

36. Find  $\sin 2C$

- A.  $\frac{3}{5}$       **(B)  $\frac{4}{5}$**       C.  $\frac{4}{3}$       D.  $\frac{5}{3}$       E. 2

37. Find  $\cot 2C$

A.  $\frac{5}{3}$

B.  $\frac{5}{4}$

☒ C.  $\frac{3}{4}$

D.  $\frac{3}{5}$

E. 1

38. Find  $\cos 2C$

A.  $\frac{3}{5}$

☒ B.  $-\frac{3}{5}$

C.  $-\frac{4}{5}$

D.  $\frac{4}{5}$

E.  $-\frac{2}{\sqrt{5}}$

39. Find  $\cot \theta$ , given that  $\cos = \frac{21}{29}$  and  $\theta$  is in the fourth quadrant

A.  $-\frac{21\sqrt{2}}{4}$

B.  $\frac{29}{21}$

☒ C.  $-\frac{20}{21}$

D.  $-\frac{21}{20}$

E.  $\frac{1}{20}$

40. Find the exact trigonometric function value of  $\cos 960^\circ$

A.  $-\sqrt{3}$

B.  $\frac{\sqrt{2}}{2}$

☒ C.  $-\frac{1}{2}$

D.  $-\frac{\sqrt{3}}{2}$

E.  $\frac{1}{2}$

41. Simplify  $1 - 2\sin^2 x + \sin^4 x$

A.  $1 + \tan^2 x$

B.  $\sin^2 x$

☒ C.  $\cos^4 x$

D.  $1 - \sin^2 x$

E.  $1 + \sin^2 x$

42. Simplify  $\sin^2 \theta + \tan^2 \theta + \cos^2 \theta$

A.  $\tan^2 \theta$

☒ B.  $\sec^2 \theta$

C.  $\cos^3 \theta$

D.  $\sin \theta$

E.  $\cot^2 \theta$

43.  $\sin 2\theta = -\sin \theta$

☒ A.  $\{0^\circ, 120^\circ, 180^\circ, 240^\circ\}$

B.  $\{0^\circ, 60^\circ, 120^\circ, 180^\circ, 240^\circ, 300^\circ\}$

C.  $\{60^\circ, 120^\circ, 240^\circ, 300^\circ\}$

D.  $\{120^\circ, 150^\circ, 180^\circ, 240^\circ\}$

E. None of the above

44. Express as a function of a positive acute angle  $\cos(-305^\circ)$  is equal to

A.  $-\cos 55^\circ$

☒ B.  $\cos 55^\circ$

C.  $-\sin 55^\circ$

D.  $\sin 55^\circ$

E.  $-\tan 55^\circ$

45. If  $\tan A = \frac{2}{3}$  and  $\sin B = \frac{5}{\sqrt{41}}$  and angle A and B in the first Quadrant. Find  $\tan(A + B)$

A.  $\frac{4}{\sqrt{41}}$

B.  $\frac{1}{6}$

C.  $\frac{23}{12}$

D.  $\frac{5}{4}$

E.  $\frac{23}{4}$

☒ F.  $\frac{23}{2}$

\* 46. Eliminate  $\theta$  from the equation  $x = 1 + \tan \theta$ ,  $y = \cos \theta$

A.  $y^2(x-1)^2 + y^2 = 1$

B.  $x^2 + y^2 = 25$

C.  $xy = 1$

☒ D.  $y^2(x+1)^2 - y^2 = 1$

E.  $x^2 y^2 = 1$

47. Solve for the equation  $\sin \frac{1}{2} \theta = \frac{1}{2}$  for values  $\theta$  from  $0^\circ$  to  $360^\circ$  inclusive

A.  $30^\circ, 150^\circ$

☒ B.  $60^\circ, 300^\circ$

C.  $60^\circ, 330^\circ$

D.  $30^\circ, 240^\circ$

B. E. None of the above

48. If  $x = \sin \theta$ , simplify  $\frac{1-x^2}{x}$ .

A.  $\cos \theta$

B.  $\tan \theta$

☒ C.  $\cos \theta \cot \theta$

D.  $\sin \theta \cot \theta$

E.  $\cos \theta \tan \theta$

49. Which of the four quadrants must  $A$  lie, if both  $\sin A$  and  $\cos A$  are negative.

A. first

B. second

☒ C. third

D. fourth

E. none of these.

50. Which of the four quadrants must  $A$  lie, if both  $\tan A$  and  $\cos A$  are negative.

A. first

☒ B. second

C. third

D. fourth

E. none of these.

~~A~~ KOSAH

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## SECTION B

1. (a)

Without using calculator, compute the following table

$\sin \theta$	$\cos \theta$	$\tan \theta$	$\cos 2\theta$	$\sin 2\theta$	$\tan 2\theta$	Type of Angle
$-\frac{12}{13}$	$-\frac{5}{13}$	$\frac{12}{5}$				reflex
$\frac{3}{5}$	$-\frac{4}{5}$	$-\frac{3}{4}$				obtuse
$\frac{7}{25}$	$\frac{24}{25}$	$\frac{7}{24}$				acute

(b) Express  $\frac{x^4 - 4x^2 + x + 1}{x^2 - 4}$  into partial fraction.

2. (a) Use Cramm's Rule to solve:

$$3x + 4y - 3z = 5$$

$$3x - 2y + 4z = 7$$

$$3x + 2y - z = 3$$

(b) i. In geometric progression, the sixth term is 8 times the third term and sum of the seventh and eighth term 192. Determine

(a) the common ratio and the first term

(b) the sum of the fifth to eleventh terms inclusive.

ii. A drilling machine is to have six speeds from 50 rev/min to 750 rev/min. if the speed form a geometric progression, determine their values, each correct to the nearest whole number.