**CHAPTER ONE**

**NUMBER AND NUMERATION**

**Number bases**

**Operations In Different Number Bases From 2 To 10;**

1.  **Convert $27_{10}$ to another number in base three**

A. $1001_3$
B. $1010_3$
C. $11003_3$
D. $1000_3$
**UTME, 2013**

2.  **Find x if 132x = 70 eight.**

A. 5
B. 3
C. 6
D. 1
**UTME, 2015**

```
    1  1  0  1 . 0  1
 +  1  1  1  0 . 1  1
    1  0  1  1 . 1  0
 _____
 1  1  0  1  1  1 . 1  0
```

**3.  The base in which the operation was performed was**

A. 6
B. 2
C. 4
D. 5
**UTME, 2017**

**Conversion From One Base to Another Including Fractional Parts.**

**4.  If $x_{10}$ = $23_5$. Find x**

A. 15
B. 12
C. 14
**D. 13**
**UTME, 2016**

**5.  Calculate $243_{six}$ – $243_{five}$ expressing your answer in base 10**

A. 0
B. 1
C. 26
D. 46
**UTME, 2018**

**ANSWERS**

1. **SOLUTION**

| 3 | 27 |
|---|---|
| 3 | 9 rem 0 |
| 3 | 3 rem 0 |
| 3 | 1 rem 0 |
|   | 0 |

**Therefore, the correct option is D $1000_3$**

2. **SOLUTION**

$132_x = 70_8$

$1 \times x^2 + 3 \times x^1 + 2 \times x^0$

$7 \times 8^1 + 0 \times 8^0$

$x^2 + 3x + 2 - 56 = 0$

$x^2 + 3x - 54 = 0$

$x(x + 9) - 6(x + 9) = 0$

$(x + 9)(x - 6) = 0$

Either $(x + 9) = 0$ or $(x - 6) = 0$

$x = -9$ or $+6$

The positive values for $x = 6$

The base number for $132_x = 132_6$.

**Therefore, option C is the correct answer.**

3. **SOLUTION**

```
   1 1 0 1. 0 1
   1 1 1 0. 1 1
   1 1 1 1. 1 0
-----------------
   1 1 0 1 1 1. 1 0
```

**Therefore, B is the correct option**

4. **SOLUTION**

$x_{10} = 23_5$

$x_{10} = 2 \times 5^1 + 3 \times 5^0$

$= 10 + 3$

$= x_{10} = 13$

Therefore, $X_{10} = 13$.

**D is the correct answer**

5. **SOLUTION**

First convert the number bases to base 10

$243_{six} = (2 \times 6^2) + (4 \times 6^1) + (3 \times 6^0) = 72 + 24 + 3 = 99_{10}$

$243_{five} = 2 \times 5^2 + 4 \times 5^1 + 3 \times 5^0 = 50 + 20 + 3 = 73_{10}$

Next Subtract the two answers:

$99_{10} - 73_{10} = 26_{10}$

**The correction answer is C**

# CHAPTER TWO

**FRACTIONS, DECIMALS, APPROXIMATIONS AND PERCENTAGES:**

**Fractions**

6.  **Evaluate 1 – (1/5 x 2/3) + (5 + 2/3)**

A. 4
B. 3
C. 2⅔
D. 3⅔
**UTME, 2017**

7.  **A school girl spends ¼ of her pocket money on books and ⅓ on dress. What fraction remains?**

A. 5/6
B. 7 12
C. 5/12
D. 1/6
**UTME, 2018**

8.  **What is the product of 27/5 – 3 and (1/5)?**

A. 5
B. 3
C. 1
D. 12/25
**UTME, 2020**

**9.** $(\frac{2}{3} \div \frac{4}{5})/ (\frac{1}{4} + \frac{3}{5} - \frac{1}{3})$

A. 31/50
B. 20/31
C. 31/20
D. 50/31
**UTME, 2019**

**10. Solve the following equation:** $\frac{2}{(2r-1)} - \frac{5}{3} = \frac{1}{r+2}$

A. $(-1, 5/2)$
B. $(1, -5/2)$
C. $(5/2, 1)$
D. $(2,1)$
**UTME, 2021**

**Significant Figures**

**11. Simplify** $(0.09)^2$ **and give your answer correct to 4 significant figures**

A. 0.81
B. 0.081
C. 0.0081
D. 8.0001
**UTME, 2015**

**12. Simplify** (0.0839×6.381)/5.44 **to 2 significant figures.**

A. 0.2809
B. 2.51
C. 3.5
D. 0.098
**UTME, 2019**

**13. Express, correct to three significant figures, 0.003597.**

A. 0.359
B. 0.004
C. 0.00360
D. 0.00359
**UTME, 2020**

**14. Correct 241.34(3 x 10-3)2 to 4 significant figures**

A. 0.0014
B. 0.001448
C. 0.0022
D. 0.002172
**UTME, 2021**

**Decimal places**

**15. Evaluate (1.25 × 0.025)/0.05, correct to 1 decimal place**

A. 0.6
B. 6.2
C. 6.3
D. 0.5
**UTME, 2013**

**16. What is the place value of 9 in the number 3.0492?**

A. 9/10000
B. 9/1000
C. 9/100
D. 9/10
**UTME, 2018**

**Percentage Errors**

17. **A sales boy gave a change of N68 instead of N72. Calculate his percentage error**

A. 4%
B. 5 5/9%
C. 5 15/17%
D. 7%
**UTME, 2013**

18. **The weight of a day-old chick was measured to be 0.21g. If the actual weight of the chick is 0.18g, what was the percentage error in the measurement?**

A. 15.5%
B. 18.2%
C. 14.8%
D. 16.7%
**UTME, 2019**

**Simple Interest**

19. **Find at which rate per annum simple interest N525 will amount to N588 in 3 years.**

A. 3%
B. 2%
C. 5%
D. 4%
**UTME, 2015**

**20.If the simple interest on a sum of money invested at 3% per annum for 2½ years is N123, find the principal.**

A. N676.50
B. N820
C. N1,640
D. N4,920
**UTME, 2018**

**21. A man's initial salary is N540.00 a month and increases after each period of six months by N36.00 a month. Find his salary in the eight months of the third year.**

A. N828.00
B. N756.00
C. N720.00
D. N684.0
**UTME, 2018**

**22.Musa borrows N10.00 at 2% per month simple interest and repays N8.00 after 4 months. How much does he still owe?**

A. N10.80
B. N10.67
C. N2.80
D. N2.67
**UTME, 2021**

**Profit and Loss percent**

23. A car dealer bought a second-hand car for of 250,000 and spent N 70,000 refurbishing it. He then sold the car for N400,000. What is the percentage gain?

A. 60%
B. 32%
C. 25%
D. 20%
**UTME, 2017**

24. A trader realizes $10x - x^2$ Naira profit from the sale of x bags of corn. How many bags will give him the maximum profit?

A. 7
B. 6
C. 5
D. 4
**UTME, 2018**

25. A machine valued at N20,000 depreciates by 10% every year. What will be the value of the machine at the end of two years?

A. N16,200
B. N14,200
C. N12,000
D. N8,000
**UTME, 2018**

26. Tade bought 200 mangoes at 4 for ₦2.50. 30 out of the mangoes got spoilt and the remaining were sold at 2 for ₦2.40. Find the percentage profit or loss.

A. 43.6% loss
B. 35% profit
C. 63.2% profit
D. 28% loss
**UTME, 2019**

**Ratio, Proportion and Rate**

27. 3 girls share a number of apples in the ration 5:3:2. If the highest share is 40 apples, find the smallest share

A. 36
B. 24
C. 16
D. 38
**UTME, 2013**

28. In a town of 6250 inhabitants, there were 62 births during 1984. Find the percentage birth rate

A. 3%
B. 1.0%
C. 2.5%
D. 5.40%
**UTME, 2015**

**29.** **If three staff of Myschool Limited agreed to share their salary arrears in the ration of their ages, which are 18 years, 20 years, 22 years respectively. If the sum of the money collected is N120,000.00K, how much does the second staff received?**

A. N36,000
B. N44,000
C. N40,000
D. N15,000
**UTME, 2015**

**30.** **Two sisters, Taiwo and Kehinde, own a store. The ratio of Taiwo's share to Kehinde's is 11:9. Later Kehinde sells ⅔ of her share to Taiwo for N720.00. Find the value of the store**

A. N1,080.00
B. N2,400.00
C. N3,000.00
D. N3,600.00
**UTME, 2018**

**31.** **The ratio of the length of two similar rectangular blocks is 2 : 3. If the volume of the larger block is 351cm33, then the volume of the other block is?**

A. 234.00 cm$^3$
B. 526.50 cm$^3$
C. 166.00 cm$^3$
D. 687cm$^3$
**UTME, 2021**

**Shares And Valued Added Tax (VAT)**

32. A man with an annual salary of N2000, has allowances of N600. If Income Tax is 5%. How much tax does he pay each year?

A. 15
B. 20
C. 70
D. 25
**UTME, 2015**

33. If an investor invest N450,000 in a certain organization in order to yield X as a return of N25,000. Find the return on an investment of N700,000 by Y in the same organization.

A. N14,950.50K
B. N25,150.30K
C. N15,000.00K
D. N38,888.90K
**UTME, 2015**

**ANSWERS**

6. **SOLUTION**
   $1 - (1/5 \times 2/3) + (5 + 2/3)$
   First simplify the operations in bracket
   $= 1 - (2/15) + (17/3)$

7. **SOLUTION**
   $1/4 + 1/3$
   Find the LCM and simplify to get $7/12$
   Since pocket money is a whole number which is 1
   Then $1 - 7/12 = 5/12$
   **Therefore, the correction is C**

8. **SOLUTION**
   product of $27/5 - 3$ and $(1/5)$?
   $27/5 - 3$ (By taking the LCM and simplifying) $= 12/5$
   $= 12/5 \times 1/5 = 12/25$
   **Therefore, the right answer is D**

9. **SOLUTION**
   $(\,^2/_3 \div ^4/5\,) / (\,^1/_4 + ^3/5 - ^1/_3\,)$
   $^2/_3 \, ^4/5 (\,^1/_4 + ^3/5 - ^1/_3\,) = (10/12) / (31/60)$
   $= 10/12 \ 60/31 = 50/31$
   **Therefore, the correct option is D**

**10. SOLUTION**

$$\frac{2}{(2r-1)} - \frac{5}{3} = \frac{1}{r+2}$$

$$= \frac{2}{(2r-1)} - \frac{1}{r+2} = \frac{5}{3}$$

Find L.C.M and we have;

$$\frac{2(r+2) - 1(2r-1)}{(2r-1)(r+2)} = \frac{5}{3}$$

$$= \frac{2r+4-2r+1}{(2r-1)(r+2)} = \frac{5}{3}$$

cross multiply the solution

3 = (2r – 1) (r + 2) or $2r^2 + 3r - 2$ (when expanded)

collect like terms

$2r^2 + 3r - 2 - 3 = 0$

$2r^2 + 3r - 5 = 0$

Factorize to get x = 1 or $-5/2$

**Therefore, the right answer is B**


**11. SOLUTION**

$(0.09)^2$ = 0.09 × 0.09 = 0.0081

= 0.008100 to 4 significant figures

Please, start counting from the first non-zero digit after the decimal point, exactly 4 counts to your right.

**Therefore, the correct option is C.**

**12. SOLUTION**

$$\frac{0.0839 \times 6.381}{5.44} = \frac{0.534}{5.44} = 0.098$$

**Therefore, D is the correct option**


**13. SOLUTION**

0.003597 = 0.00360 to 3 significant figures.

**Therefore, the correct answer is C**

**14. SOLUTION**

$3^2x^2$

$= 1/10^3 \times 1/10^3$

(Note that $x^2 = 1/x^3$)

$= 24.34 \times 3^2 \times 1/10^6$

$= 2172.06/10^6$

$= 0.00217206$

$= 0.002172$ (4 s.f)

**Therefore, the correct answer is D**


**15. SOLUTION**

$\dfrac{(1.25 \times 0.025)}{0.05}$ **=** $\dfrac{125 \times 10^{-2} \times 25 \times 10^{-3}}{5 \times 10^{-2}}$ **=** $125 \times 5 \times 10^{-3}$

$= 625 \times 0.001$

$= 0.625$

$= 0.6$ Approx to 1 d.p.

**Therefore, the correct answer is A**

**16. SOLUTION**

The place value or position of 9 in 3.0492 is $\dfrac{9}{1000}$.

**Therefore, the correct answer is B**

**17. SOLUTION**

Percentage error $= \dfrac{(\text{Approximate value} - \text{exact value})}{\text{Exact value}} \times 100$

P.E $= \dfrac{72-68}{68} = \dfrac{4}{68} \times 100 = 5\dfrac{5}{9}\%$

**Therefore, the right answer is B**

**18. SOLUTION**

Actual weight = 0.18g

Estimated weight = 0.21g

Error = 0.21g - 0.18g = 0.03g

Percentage error = $\frac{(0.21-0.18)}{0.03} \times 100 = 16.7\%$

**Therefore, the right option is D**

**19. SOLUTION**

I = A - P

= N588 - N525

I = N63

I = PRT ÷ 100

R = $(100I \div PT)$

R = $[(100 \times 63) \div (525 \times 3)]$

= $(6300 \div 1575) = 4$

The rate = 4 %

**Therefore, the correct answer is D**

**20. SOLUTION**

I = 123; R = 3%; T = $2\frac{1}{2}$ Years;

P = $\frac{100 \times I}{RT} = \frac{100 \times 123}{3 \times 2.5} = 1640$

Principal = 1640

**Therefore, C is the right answer**

### 21. SOLUTION

Initial salary = ₦540

increment = ₦36 (every 6 months)

Period of increment = 2 years and 6 months

amount(increment) = ₦36 x 5 = ₦180

The man's new salary = ₦540 = ₦180

= ₦720

**Therefore, C is the correct answer**

### 22. SOLUTION

Simple Interest = $\frac{p \times R \times T}{100}$

Simple Interest = $\frac{10 \times 2 \times 4}{100} = \frac{4}{5} = 0.8$

Total amount = 10.8

Payment, he made = 8

He owes = 10.8 − 8.0 = 2.8

**Therefore, the correct option is C**

### 23. SOLUTION

Total Cost Price = N(250,000 + 70,000)

= N 320,000

Selling Price = N 400,000

Gain = Selling Price - Cost Price

= 400,000 - 320,000 = 80,000

Gain% = $\frac{Gain}{CP} \times 100 = \frac{80000}{320000} \times 100$

Gain% = 25%

**The right option is C**

**24.    SOLUTION**

Profit $(P) = 10x - X^2$

To solve for the Maximum profit, the profit will be differentiated with respect to number of bags $(x)$ to get 0

$\frac{dp}{dx} = 0$

$\frac{dp}{dx} = 10 - 2x = 0$

$10 = 2x$

Then $x = \frac{10}{2} = 5$

**The right answer is C**


**25. SOLUTION**

Since it depreciates by 10% At the end of first year, its value = 90% of 20000 i.e $\frac{90}{100}$ x 20000 =18000

At the end of second year, its value = 90% of 18000

$= \frac{90}{100}$x 18000 = ₦16,200

**Therefore, the right option is A**


**26. SOLUTION**

200 mangoes at 4 for N2.50

Total cost price = $\frac{200}{4} \times 2.50$= N 125.00

Since 30 mangoes got spoilt, the remaining = 200 − 30 = 170 mangoes

170 mangoes at 2 for N 2.40

Total selling point = $\frac{170}{2} \times 2.40$ = N 204.00

Profit = N $(204.00 - 125.00)$ = N 79.00

% profit = $\frac{100}{79} \times 100$ = 63.2% profit

**The right answer is C**

**27. SOLUTION**

The sum of ratio is S = 5 + 3 + 2 = 10.

But highest share = $\frac{5}{10} \times T$, where T represents the total number of apples.

Thus, $40 = \frac{5}{10} \times T$

$T = \frac{40 \times 10}{5} = 80$

Therefore, the smallest share = $\frac{2}{10} \times 80 = 16$ apples

**The correct option is C**

**28. SOLUTION**

Percentage birthrate = $\frac{62}{6250} \times 100 = 0.992 \approx 1.0\%$

**Therefore, the right answer is B**

**29. SOLUTION**

Total of their ages = 18 + 20 + 22 = 60

The second staff will get $\frac{20}{60} \times 120,000 = N40,000$

**The right option is C**

**30. SOLUTION**

Total ratio = 11 + 9 = 20

Taiwo's share = 11/20

Kehinde's share = 9/20

2/3 × 9/20 = 3/10 (percentage of total shares sold to Taiwo)

3x/10 = ₦720

3x = ₦7200

x = ₦2400

**Therefore, the correct option is B**

### 31. SOLUTION

Let x represent total vol. 2: 3 = 2 + 3 = 5

$(\frac{3}{5})x = 351$

x = (351×5) /3 = 585

Volume of smaller block =

2/5 x 585 = 234.00cm3

**Therefore, the correct option is A**

### 32. SOLUTION

His annual salary = N2000

His allowances = N600

Thus, his taxable income = Annual salary - allowance

= N2000 - N600 = N1400

He pay at 5%

Then, his allowance income tax 5/100 × 1400 = N70

**Therefore, C is the correct option**

### 33. SOLUTION

Return ÷ Investment] as a ratio;

i.e The Ratio is Return : Investment

[(Return1÷ Investment1 ) = (Return2÷ Investment2)]

R1 = N 25000 : R2 =?

I1 = N450,000 : I2 = N 700000

(25000 ÷ 450000) = (R2 ÷ 700000)

R2 = [(25000 × 700000 ) ÷ 450000]

= N38,888.90K

The return on investment of Y = N38888.90K

**Therefore, the right answer is D**

# CHAPTER THREE

## INDICES, LOGARITHMS AND SURDS:

### Laws of Indices

**34.** If $9^{(2 - x)} = 3$, find x

A. 1
B. 3/2
C. 2
D. 5/2
**UTME, 2013**

**35. Solve for x in $8x^{-2} = 2/25$**

A. 4
B. 6
C. 8
D. 10
**UTME, 2014**

**36. Simplify $3^{n-1} \times 27^{n+1}/81^n$**

A. $3^{2n}$
B. 9
C. $3^n$
D. $3^{n+1}$
**UTME, 2017**

**37.If $27^x = 9^{(x-y)}$, then the formula connecting x and y is**

A. x+2y = 0

B. x−2y = 0

C. $x^2+2y^2 = 0$

D. x+2y = 1

**UTME, 2020**

## Standard Form

**38.  Multiply $2.7 \times 10^{-4}$ by $6.3 \times 10^6$ and leave your answers in standard form**

A. $1.7 \times 10^3$

B. $1.70 \times 10^3$

C. $1.701 \times 10^3$

D. $17.01 \times 10^3$

**UTME, 2013**

**39.Express the product of 0.00043 and 2000 in standard form.**

A. $8.6 \times 10^{-3}$

B. $8.3 \times 10^{-2}$

C. $8.6 \times 10^{-1}$

D. $8.6 \times 10$

**UTME, 2014**

**40.  Simplify $(0.026 \times 0.36)/(0.69)$. Leave your answer in standard form**

A. $1.36 \times 10^{-4}$

B. $1.36 \times 10^{-3}$

C. $1.36 \times 10^{-1}$

D. $1.36 \times 10^{-2}$

**UTME, 2016**

**41. Evaluate 0.00000231/0.007 and leave the answer in standard form**

A. $3.3 \times 10^{-4}$
B. $3.3 \times 10^{-3}$
C. $3.3 \times 10^{-5}$
D. $3.3 \times 10^{-8}$
**UTME, 2017**

**42. Simplify and express in standard form** $\dfrac{0.00275 \times 0.00640}{0.025 \times 0.08}$

A. $8.8 \times 10^{-1}$
B. $8.8 \times 10^{-2}$
C. $8.8 \times 10^{-3}$
D. $8.8 \times 10^{3}$
**UTME, 2021**

**Laws Of Logarithm**

**43. If log7.5 = 0.8751, evaluate 2 log75 + log750**

A. 6.6252
B. 6.6253
C. 66.252
D. 66.253
**UTME, 2014**

**44. Simplify $\log_{10} 1.5 + 3 \log_{10} 2 - \log_{10} 0.3$**

A. $\log_{10} 14$
B. $\log_{10} 40$
C. $\log_{10} -40$
D. $\log_{10} 4^{-}$
**UTME, 2015**

### 45. Simplify 2log 2/5 – log72/125 + log 9

A. 1 – 4 log3
B. –1 + 2 log 3
C. –1 + 5 log2
D. 1 – 2log 2
**UTME, 2021**

## Logarithm Of Any Positive Number to A Given Base

### 46. If $\log_5 20 = x$, find x

A. 1.761
B. 1.354
C. 1.861
D. 2.549
**UTME, 2015**

### 47.Find x if $\log_9 x = 1.5$

A. 27
B. 15
C. 3.5
D. 32
**UTME, 2021**

## Change Of Bases in Logarithm And Application

**48.    Evaluate $\log_2 8 - \log_3 1/9$**

A. $-1\frac{1}{2}$
B. $-1$
C. $1$
**D. 5**
**UTME, 2018**

## Relationship Between Indices And Logarithm

**49.    Evaluate $\log 5(y^2 x^5 \div 125 b^{\frac{1}{2}})$**

A. $2\log 5y + 5\log 5\ y^2 - 3$
B. $\log 5\ y^2 + 5\log 5\ x + 3$
C. $25\log y\ 5 + 3$
D. $2\log 5y + 5\log 5x - \frac{1}{2}\log 5b - 3$
**UTME, 2015**

## Surds.

**50.    Rationalize $(\sqrt{2}+\sqrt{3})/(\sqrt{2}-\sqrt{3})$**

A. $-5-2\sqrt{6}$
B. $-5+3\sqrt{2}$
C. $5-2\sqrt{3}$
D. $5+2\sqrt{6}$
**UTME, 2019**

**51. Simplify √27 + 3/√3**

A. 4√3
B. 4/√3
C. 3√3
D. √3/4
**UTME, 2021**

**ANSWERS**

**34. SOLUTION**

$9^{(2-x)} = 3$

$3^{2(2-x)} = 3$

$2(2-x) = 1$

$4 - 2x = 1$

$3 = 2x$

$x = 3/2$

**Therefore, the right option is B**

**35. SOLUTION**

$8x^{-2} = 2/25$

$8 \times \dfrac{1}{x^2} = \dfrac{2}{5}$

Cross multiply

$2x^2 = 8 \times 25$

$2x^2 = 200$

$x^2 = 100$

$x = 10$

**Therefore, the right option is D**

**36. SOLUTION**

$3^{n-1} \times 27^{n+1}/81^n$

$= 3^{n-1} \times 3^{3(n+1)} \times 3^{4(-n)}$

By applying the law of indices, we have;

$= 3^{(n-1 + 3n+3 - 4n)}$

$= 3^{4n-4n + 2}$

$= 3^{0+2} = 3^2$

$= 9$

**Therefore, the right option is B**

**37. SOLUTION**

$27^x = 9^{(x-y)}$

$3^{3x} = 3^{2(x-y)}$

$= 3x = 2(x-y)$

$3x = 2x - 2y$

$3x - 2x = -2y$

$x + 2y = 0$

**Therefore, the right option is A**

**38. SOLUTION**

$2.7 \times 10^{-4} \times 6.3 \times 10^6$

$= 2.7 \times 6.3 \times 10^{-4} \times 10^6$

$= 17.01 \times 10^{-4+6} = 17.01 \times 10^2$

$= 1.701 \times 10^1 \times 10^2 = 1.701 \times 10^{1+2}$

$= 1.701 \times 10^3$

**Therefore, the right option is C**

**39. SOLUTION**

$0.00043 \times 2000 = 43 \times 10^{-5} \times 2 \times 10^3$

$= 43 \times 2 \times 10^{-5+3} = 86 \times 10^{-2}$

$= 8.6 \times 10^1 \times 10^{-2} = 8.6 \times 10^{-1}$

**Therefore, the correct option is C**

**40. SOLUTION**

$$\frac{0.026 \times 0.36}{0.69} = \frac{26 \times 10^{-3} \times 36 \times 10^{-2}}{69 \times 10^{-2}}$$

$0.01356 = 1.36 \times 10^{-2}$

**The correct option is D**

**41. SOLUTION**

$$\frac{0.00000231}{0.007} = \frac{231 \times 10^{-8}}{7 \times 10^{-3}}$$

$33 \times 10^{-8-(-3)} = 33 \times 10^{-8+3}$

$= 33 \times 10^{-5} = 3.3 \times 10^{-4}$

**Therefore, the right answer is A**

**42.    SOLUTION**

$$\frac{0.00275 \times 0.0064}{0.025 \times 0.08}$$

Simplify to eliminate the decimals

$$= \frac{275 \times 64}{2500 \times 800}$$

$$\frac{88}{10^4}$$

$88 \times 10{-4} = 88 \times 10{-1} \times 10{-4}$

$= 8.8 \times 10^{-3}$

**Therefore, C is the correction option.**

**43.    SOLUTION**

If log 7.5 = 0.8751

Therefore, 2log75 + log750 = 2(1.8751) + 2.8751

= 3.7502 + 2.8751 = 6.6253

**Therefore, the right answer is B**

**44.    SOLUTION**

$\log_{10} 1.5 + 3 \log_{10} 2 - \log_{10} 0.3$

$\log_{10} \left( \frac{1.5 \times 2^3}{0.3} \right) = \log_{10} \left( \frac{1.5 \times 8}{0.3} \right)$

$\log_{10} 40$

**Therefore, the right answer is B**

**45. SOLUTION**

$2\log \frac{2}{5} - \log\frac{72}{125} + \log 9$

$\left[(2/5)2 \times 9\right] = \log \frac{4}{25} \times \frac{1}{9} \times \frac{125}{72}$

$= \log \frac{72}{125}$

$= \log \frac{5}{2}$

$= \log \frac{10}{4}$

$= \log 10 - \log 4$

$= \log10 - \log2^2$

$= 1 - 2 \log2$

**Therefore, correct option is D**

**46. SOLUTION**

$\log_5 20 = x$

$5x = 20 (\text{Take } \log_{10} \text{ of both sides})$

$\log_{5x} = \log_{20} = x\log_5 = \log_{20}$

$x = (\log_{20} \div \log_5) = (1.30103 \div 0.69897)$

$x = 1.861$

**Therefore, the correct answer is C**

**47. SOLUTION**

$\log_7 17 = (\log 17 \div \log7)$

$= (1.2304 \div 0.8451)$

$(10^{0.0899} \div 10^{1.9270}) = 1.455 (\text{antilog})$

**Therefore, C is the right option**

**48.  SOLUTION**

$\text{Log}_2 8 - \log_3 19$

$= \log_2 2^3 - \log_3 9^{-1} = \log_2 2^3 - \log_3 3^{-2}$

Based on law of logarithm

$= 3 \log_2 2 - (-2 \log_3 3)$

But $\log_2 2 = 1$,

$\log_3 3 = 1$

Therefore we have, $= 3 + 2 = 5$

**Hence, the correct answer is D**


**49.  SOLUTION**

$\log_5 (y^2 x^5 \div 125 b^{1/2})$

$= (\log_5 y^2 + \log_5 x^5 - [\log_5 125 + \log_5 b^{1/2})$

$= (2\log_5 y + 5\log_5 x - 3 - \tfrac{1}{2} \log_5 b)$

**Therefore, the correct option is D**


**50.  SOLUTION**

So, we are multiplying the surds with $\left(\frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}+\sqrt{3}}\right)$

So now $\frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}-\sqrt{3}} = \frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}-\sqrt{3}} \times \frac{\sqrt{2}+\sqrt{3}}{\sqrt{2}+\sqrt{3}} = \frac{2+3+2\sqrt{6}}{2-3} = -5 - 2\sqrt{6}$

**Correct option is A**


**51. SOLUTION**

$\sqrt{27} + \frac{3}{\sqrt{3}}$

$= \sqrt{9 \times 3} + \frac{3 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}}$

$= 3\sqrt{3} + \sqrt{3}$

$= 4\sqrt{3}$

**Therefore, A is the correct option**

# CHAPTER FOUR

**Sets:**

**Types of sets**

**52. Given that A = {1, 5, 7}, B = {3, 9, 12, 15}, C = {2, 4, 6, 8}**

**Find (A ∪ B) ∪ C**

A. {1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 15}
B. {1, 2, 3, 5, 6, 8, 12, 15}
C. {2, 4, 5, 9, 12, 15}
D. {1, 5, 6, 7, 8, 9, 12, 15}
**UTME, 2015**

**53. Given U = {x: x is a positive integer less than 15} and P = {x: x is even number from 1 to 14}. Find the compliment of P.**

A. {1, 3, 5, 7, 9, 11, 13, 15}
B. {2, 3, 5, 7, 9, 11, 13}
C. {1, 3, 5, 7, 9, 11, 13}
D. {2, 3, 5, 7, 11, 15}
**UTME, 2016**

**54. Given T = {even numbers from 1 to 12}, N = {common factors of 6, 8 and 12}, Find T ∩ N**

A. {2, 3}
B. {2, 3, 4}
C. {3, 4, 6}
D. {2}
**UTME, 2017**

**Algebra of Sets**

**55.** **In a class of 40 students, 32 offer Mathematics, 24 offer Physics and 4 offer neither Mathematics nor Physics. How many offers both Mathematics and Physics?**

A. 4
B. 8
C. 16
D. 20
**UTME, 2018**

**Venn Diagrams and Their Applications.**
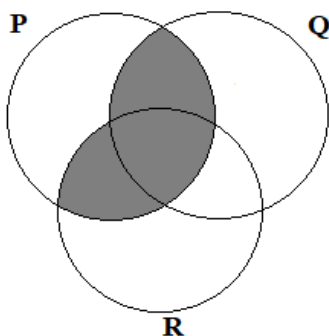


**56.** **if P = {x:x is odd, –1<x≤20} and Q is {y:y is prime, –2<y≤25, find P ∩ Q**

A. {3,5,7,11,17,19}
B. {3,5,11,13,17,19}
C. {3,5,7,11,13,17,19}
D. {2,3,5,7,11,13,17,19}
**UTME, 2013**

**57.If P = {1,2,3,4,5} and P ∪ Q = {1,2,3,4,5,6,7}, list the elements in Q**

A. {6}
B. {7}
**C. {6,7}**
D. {5,6}
**UTME, 2014**

**58.   X and Y are two sets such that n (X) = 15, n(Y) = 12 and n {X ∩ Y} = 7. Find ∩ {X ∪ Y}**

A. 21
B. 225
C. 15
**D. 20**
**UTME, 2015**

**59.   The venn diagram shows a class of 50 students with the games they play. How many students play only two games?**
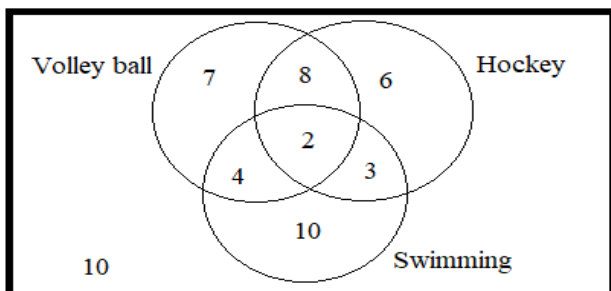


A. 15
B. 16
C. 20
D. 18
**UTME, 2016**

**60.** A group of market women sell at least one of yam, plantain and maize. 12 of them sell maize, 10 sell yam and 14 sell plantain. 5 sell plantain and maize, 4 sell yam and maize, 2 sell yam and plantain only while 3 sell all the three items. How many women are in the group?

A. 25
B. 19
C. 18
D. 17
**UTME, 2021**

**ANSWERS**

**52.SOLUTION**

$\{A \cup B \cup C\}$

$\{A \cup B\} = \{1, 3, 5, 7, 9, 12, 15\}$

$\cup C = \{2,4,6,8\}$

$\{A \cup B\} \cup C = \{1, 3, 5, 7, 9, 12, 15\} \cup \{2, 4, 6, 8\}$

$= \{1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 15\}$

$\{A \cup B\} \cup C = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 15\}$

**Therefore, the correct answer is C**

**53.   SOLUTION**

$U = \{1, 2, 3, 4, 5......14\}$

$P = \{2, 4, 6, 8, 10, 12, 14\}$

$P' = \{1, 3, 5, 7, 9, 11,13\}$

**Therefore, C is the right option**

**54.   SOLUTION**

$T = \{$even numbers from 1 to 12$\}$

$N = \{$common factors of 6,8 and 12$\}$

Find $T \cap N$

$T = \{2, 4, 6, 8, 10, 12\}$

$N = \{2\}$

$T \cap N = \{2\}$ i.e value common to T & N

**The right option is D**

### 55.    SOLUTION

Using a venn diagram, let x = number who offer both Maths and Physics.

So that students that offer maths $= (32-x)$ and

Students that offer physics $= (24-x)$

$(32-x) + (24-x) + (x) + (4 \text{ who offer neither}) = 40$

$= 60 - x = 40$

$-x = -20$

Therefore x = 20.

**Hence, A is the correct option.**

### 56.    SOLUTION

P = $\{1, 3, 5, 7, 9, 11, 13, 15, 17, 19\}$

Q = $\{-1, 3, 5, 7, 11, 13, 17, 19, 23\}$

P $\cap$ Q = $\{3, 5, 7, 11, 13, 17, 19\}$

**The right option is C**

### 57. SOLUTION

Q = $(P \cup Q) - P$

$\{6, 7\}$

**Therefore, the right answer is C**

### 58.    SOLUTION

$n(X \cup Y) = n(X) + n(Y) - n(X \cap Y)$

$= 15 + 12 - 7$

Therefore, $n(X \cup Y) = 20$

**Hence the right answer is D**

### 59.    SOLUTION

The number of students that plays only two games = 4 + 8 + 3 = 15

**Therefore, the right answer is A**

**60.    SOLUTION**

Let the three items be M, Y and P.

$n\{M \cap Y\}$ only $= 4-3 = 1$

$n\{M \cap P)$ only $= 5-3 = 2$

$n\{Y \cap P\}$ only $= 2$

$n\{M\}$ only $= 12-(1+3+2) = 6$

$n\{Y\}$ only $= 10-(1+2+3) = 4$

$n\{P\}$ only $= 14-(2+3+2) = 7$

$n\{M \cap P \cap Y\} = 3$

Number of women in the group $= 6+4+7+(1+2+2+3)$ as above $= 25$ women.

**Therefore, correct option is A**

# CHAPTER FIVE

**ALGEBRA.**

**Polynomials:**

**Change of Subject of Formula**

61. Given that $p^{1/3} = (3\sqrt{q})/r$, make q the subject of the equation

A. $q = p\sqrt{r}$
B. $q = p^3 r$
C. $q = pr^3$
D. $q = pr^{1/3}$
**UTME, 2013**

62. If $S = \sqrt{t^2 - 4t + 4}$, find t in terms of S

A. $S^2 - 2$
B. $S + 2$
C. $S - 2$
D. $S^2 + 2$
**UTME, 2013**

63. If $x/(a+1) + y/b = 1$. Make y the subject of the relation.

A. $b(a+1-x)/a+1$
B. $(a+1)/b(a-x+1)$
C. $a(b-x+1)/b+1$
D. $b/a(b-x+1)$
**UTME, 2018**

**64. Make T the subject of the relation.**

A. $T = (R+P^3)/15Q$
B. $T = (R-15P^3)/Q$
C. $T = RQ - 15P^3/Q$
D. $T = (15R+Q)/p^3$

**UTME, 2018**

**65. Make q the subject of the formula in the equation $(mn)/a^2-(pq)/b^2 =1$**

A. $q=b^2(mn-a^2)/a^2p$
B. $q=(m^2n-a^2)/p^2$
C. $q=(mn-2b^2)/a^2$
D. $q=b^2(n^2-ma^2)/n$

**UTME, 2019**

**Factor and Remainder Theorems**

**66. Factorize $2y^2 - 15xy + 18x^2$**

A. $(2y - 3x)(y + 6x)$
B. $(2y - 3x)(y - 6x)$
C. $(2y + 3x)(y - 6x)$
D. $(3y + 2x)(y - 6x)$

**UTME, 2014**

**Factorization of Polynomials of Degree not Exceeding 3.**

**67. Simplify $1/(x+1) + 1/(x-1)$**

A. $2x/(x+1)(x-3)$
B. $2/(x+1)(x-1)$
C. $2x/(x+1)^2$
D. $2x/(x+1)^2$
**UTME, 2015**

**68.  Solve:  $(y+1)/2 - (2y-19/3 = 4$**

A. $y = 19$
B. $y = -19$
C. $y = -29$
D. $y = 29$
**UTME, 2020**

**69.  If $\frac{1}{2}x + 2y = 3$ and  $3/2x$ and $3/2x - 2y = 1$, find $(x + y)$**

A. 3
B. 2
C. 1
D. 5
**UTME, 2013**

**70. Factorize $2y^2 - 15xy + 18x^2$**

A. $(2y - 3x)(y + 6x)$
B. $(2y - 3x)(y - 6x)$
C. $(2y + 3x)(y - 6x)$
D. $(3y + 2x)(y - 6x)$
**UTME, 2014**

**71. Factorize $x^2$ + 9x + 20**

A. $(x - 5)^2$
B. $(x + 5)(x + 4)$
C. $(x - 5)(x + 3)$
D. $(x + 3)^2$
**UTME, 2015**

**72. factorize $m^3 - m^2$ + 2m - 2**

A. $(m^2 + 1)(m - 2)$
B. $(m - 1)(m + 1)(m + 2)$
C. $(m - 2)(m + 1)(m - 1)$
D. $(m^2 + 2)(m - 1)$
**UTME, 2021**

**Multiplication And Division Of Polynomials**

**73. Simplify $[1÷(x^2+3x+2)]+[1÷(x^2+5x+6)]$**

A. $2/(x+1)^2$
B. $2/(x+1)(x+2)$
C. $2/(x+1)(x+2)$
D. $2/(x+1)(x+3)$
**UTME, 2015**

**74. What is the product of $2x^2$ - x + 1 and 3 - 2x**

A. $4x^3 - 8x^2 + 5x + 3$
B. $-4x^3 + 8x^2 - 5x + 3$
C. $-4x^3 - 8x^2 + 5x + 3$
D. $4x^3 + 8x^2 - 5x + 3$
**UTME, 2017**

**75.If $f(x)=3x^3+4x^2+x-8$, what is the value of $f(-2)$?**

A. −24
B. 30
C. −18
D. −50
**UTME, 2019**

**Roots Of Polynomials Not Exceeding Degree 3**

**76.If $x-4$ is a factor of $x^2-x-k$, then k is**

A. 4
B. 12
C. 20
D. 2
**UTME, 2013**

**77.Find the value of k if $y-1$ is a factor of $y^3+4y^2+ky-6$**

A. −6
B. −4
C. O
D. 1
**UTME, 2014**

**78.If $\alpha$ and $\beta$ are the roots of the equation $3x^2 + bx - 2 = 0$. Find the value of $1/\alpha + 1/\beta$**

A. $-5/3$
B. $-2/3$
C. $\frac{1}{2}$
D. $5/2$

**UTME, 2017**
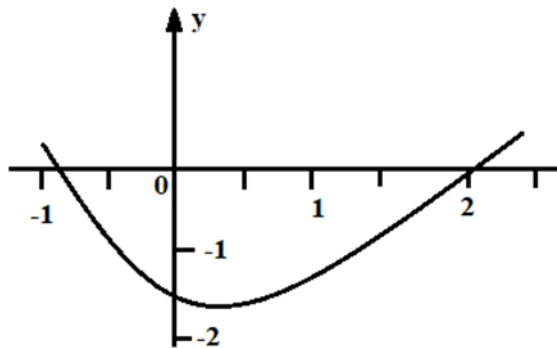


**79.The expression $a^3 + b^3$ is equal to**

A. $(a^2 + b)(a - ab + b^2)$
B. $(a + b)(a^2 - ab + b^2)$
C. $(a - b)(a^2 - ab + b)$
D. $(a - b)(a^2 + ab + b^2)$

**UTME, 2020**

**Simultaneous Equations Including One Linear One Quadratic**

**80.    Solve for x and y respectively**

**3x – 5y = 9**

**6x – 4y = 12**

A. ¾, 1
B. 4/3, 1
C. ¾, –1
D. 4/3, –1
**UTME, 2016**

**81. Find the value of x and y in the simultaneous equation: 3x + y = 21; xy = 30**

A. x = 3 or 7, y = 12 or 8
B. x = 6 or 1, y = 11 or 5
C. x = 2 or 5, y = 15 or 6
D. x = 1 or 5, y = 10 or 7
**UTME, 2019**

## Graphs Of Polynomials Of Degree Not Greater Than 3.
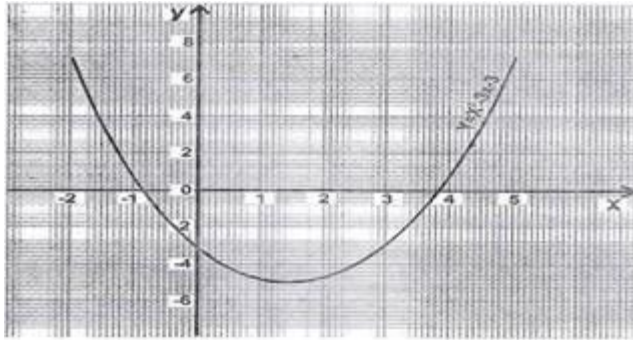


**82.The graph above is correctly represented by**

A. $y = x^2 - x - 2$
B. $y = x^2 - 3x + 2$
C. $y = x^2 - x - 1$
D. $y = x^2 + x - 2$
**UTME, 2013**

## ANSWERS

### 61. SOLUTION

$P^{\frac{1}{3}} = \frac{3\sqrt{q}}{r}$

$3\sqrt{q} = r \times 3\frac{\sqrt{q}}{r}$ (Cross multiply)

$3\sqrt{q} = 3 \times \sqrt{P}$ (cube root both side)

$q = r^{\frac{1}{3}}p = pr^{\frac{1}{3}}$

**Therefore, the right option is D**


### 62. SOLUTION

$S = \sqrt{t^2 - 4t + 4}$

$s^2 = t^2 - 4t + 4 = t^2 - 4t + 4 - S^2 = 0$

Using the formula, $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$t = \frac{-(-4) \pm \sqrt{(-4)^2 - 4(1)(4-s^2)}}{2(1)}$

$t = \frac{2(2 \pm S)}{2}$

Therefore, t = 2 + S or t = 2 − S

**Hence B is the right option**


### 63. SOLUTION

$\frac{bx + y(a+1)}{b(a+1)} = 1$

bx+ya+y = ba+b;y(a+1)

=ba+b-bxy(a+1) =b(a+1-x);

$y = \frac{b(1+a-x)}{a+1}$

**Therefore, the correct option is A**

### 64. SOLUTION

Taking the cube of both sides of the equation give

$P^3 = \frac{Q(R-T)}{15} = 15P^3 = Q(R - T)$

Divide both sides by Q

$\frac{15P^3}{Q} = R - T$

$T = \frac{RQ - 15P^3}{Q}$

**Therefore, the right answer is C**

### 65. SOLUTION

Moving the term with q to the right-hand side

$\frac{mn}{a^2} - 1 = \frac{pq}{b^2}$ then multiplying both sides by $b^2$ and dividing by p yields

$\frac{b^2}{p}\left(\frac{mn}{a^2} - 1\right) = q = \frac{b^2}{p}\left(\frac{mn-a^2}{a^2}\right) = \frac{b^2(mn-a^2)}{a^2p}$

**Correct option is A**

### 66. SOLUTION

$2y^2 - 15xy + 18x^2$

$= 2y^2 - 12xy - 3xy + 18x^2$

$= 2y(y - 6x) - 3x(y - 6x)$

$= (2y - 3x)(y - 6x)$

**Therefore, B is the right answer**

**67.** $[1 \div (x+1)] + [1 \div (x-1)]$

$= ((x-1) + [(x+1)) \div (x+1)(x-1)]$

Using the L.C.M.

$= (x-1+x+1) \div (x+1)(x-1)$

$= (x+2-1+1) \div (x+1)(x-1)$

$= 2x / (x+1)(x-1) = 2x / (x+1)(x-1)$

**Therefore, B is the correct answer**

**68.   SOLUTION**

Take L.C.M of left hand side

$(3(y+1) - 2(2y-1))/6 = 4$

$(3y + 3 - 4y + 2)/6 = 4$

$(-y + 5)/6 = 4$

$-y + 5 = 24$

$-y = 24 - 5$

$-y = 19$

$y = -19$

**Therefore, the correct option is B**

**69.   SOLUTION**

$\frac{1}{2}x + 2y = 3$   (i) (multiply by 2)

$\frac{3}{2}x - 2y = 1$   (ii) (multiply by 2)

$x + 4y = 6$   (iii)

$3x - 4y = 2$   (iv) add (iii) and (iv)

$4x = 8, 4x = 8, x = 2$

Substitute $x = 2$ into equation (iii)

$x + 4y = 6$

$2 + 4y = 6$

$4y = 6 - 2$   $y = 4$

y = 1

Therefore, $(x+y)=2+1=3$

**Hence, A is the right answer**


## 70. SOLUTION

$2y^2 - 15xy + 18x^2$

$= 2y^2 - 12xy - 3xy + 18x^2$

$= 2y(y - 6x) - 3x(y - 6x)$

$= (2y - 3x)(y - 6x)$

**Therefore, B is the right answer**


## 71. SOLUTION

$(x^2 + 9x + 20)$

Find the two numbers whose product is 20 and its sum is 9}

$(5x \times 4x = 20x^2)$ and $(5x + 4x = 9x)$

$((x^2 + 5x) + (4x + 20))$

$= x(x + 5) + 4(x + 5)$

$= (x + 5)(x + 4)$

**Therefore, B is the correct option**


## 72. SOLUTION

$m^3 - 2m^2 - m + 2$

Let $f(m) = m^3 - 2m^2 - m^2 + 2$

$= f(1)$

$= 1 - 2 - 2 + 2 = 0$

$\therefore m - 1$ is factor $(frac\{m^3 - 2m^2 - m^2 + 2\}\{m - 1\})$

$= m^2 - m - 2$

$= (m - 1)m^2 - m - 2$

$= (m - 1)(m + 1)(m - 2)$

**Therefore, C is the right answer**

**73.SOLUTION**

$[1 \div (x^2+3x+2)] + [1 \div (x^2+5x+6)]$

$= 1 \div (x^2+3x+2) + [1 \div (x^2+5x+6)]$

$= [1 \div ((x^2+x)+(2x+2))] + [1 \div ((x^2+3x)+(2x+6))]$

$= [1 \div (x(x+2)+2(x+1))] + [1 \div (x(x+3)+2(x+3))]$

$= [1 \div (x+1)(x+2)] + [1 \div ((x+3)+(x+2))]$

$= ((x+3)+(x+1)) \div (x+1)(x+2)(x+3)$

Using the L.C.M

$= ((x+x+3+1)) \div (x+1)(x+2)(x+3)$

$= (2x+4)/(x+1)(x+2)(x+3) = 2(x+2)/(x+1)(x+2)(x+3)$

$= \dfrac{2}{(x+1)(x+3)}$

**Therefore, D is the correct option.**


**74.SOLUTION**

$(2x^2 - x + 1) \times (3 - 2x);$

$3(2x^2 - x + 1) - 2x(2x^2 - x + 1)$

$6x^2 - 3x + 3 - 4x^3 + 2x^2 - 2x$

$-4x^3 + 8x^2 - 5x + 3$

**Therefore, the right answer is B**


**75.SOLUTION**

$f(x) = 3x^3 + 4x^2 + x - 8$, what is the value of $f(-2)$

$= 3(-2)^3 + 4(-2)^2 + (-2) - 8$

$= 3(-8) + 4(4) - 2 - 8$

$-24 + 16 - 10 = -18$

**Therefore, C is the correct option**

### 76. SOLUTION

Let $f(x) = x^2 - x - k$

Then by the factor theorem,

$(x - 4): f(4) = (4)^2 - (4) - k = 0$

$16 - 4 - k = 0$

$12 - k = 0$

$k = 12$

**Therefore, B is the right option**

### 77. SOLUTION

if $y - 1$ is a factor of $y^3 + 4y^2 + ky - 6$, then

$f(1) = (1)^3 + 4(1)2 + k(1) - 6 = 0$ (factor theorem)

$1 + 4 + k - 6 = 0$

$5 - 6 + k = 0$

$-1 + k = 0$

$k = 1$

**Hence, D is the right option**

### 78. SOLUTION

$1/\alpha + 1/\beta = \beta + \alpha/\alpha\beta$

$3x^2 + 5x - 2 = 0$

$x^2 + 5x/3 - 2/3 = 0$

$\alpha\beta = -2/3$

$\beta + \alpha = -5/3$

Thus; $\beta + \alpha/\alpha\beta = -2/3 -2/3 = 5/2$

**Therefore, D is the correct option**

**79. SOLUTION**

$a^3+b^3$

$= a^3+b^3 = (a+b)(a^2 -ab+b^2)$

**Therefore, B is the correct option**

**80. SOLUTION**

$3x - 5y = 9$ multiply eqn 1 by 2

$6x - 4y = 12$ multiply eqn 2 by 1

By using elimination method

$6x - 10y = 18$

$-6x - 4y = 12$

$_____$

$\dfrac{6}{y} = \dfrac{6}{6}$

$y = -1$

in eq (1) $3x - 5y = 9$

$3x - 5(-1) = 9$

$3x + 5 = 9$

$3x = 4$

$x = \dfrac{4}{3}$

**81. SOLUTION**

$3x + y = 21 \dots (i);$

$xy = 30 \dots (ii)$

From (ii), ( $y = 30/x$). Putting the value of y in (i), we have

$3x + (30/x) = 21$

$3x^2 - 21x + 30 = 0$

$3x^2 - 15x - 6x + 30 = 0$

$3x(x - 5) - 6(x - 5) = 0$

$(3x - 6)(x - 5) = 0$

$3x - 6 = 0$;  $x = 2$.

$x - 5 = 0$; $x = 5$.

If $x = 2$, $y = 30/2 = 15$;

If $x = 5$, $y = 30/5 = 6$.

**Therefore, C is the correct option**

**82.** The graph crosses the x-axis at $x = -1$ and $x = 2$

Thus, $x + 1 = 0$ and $x - 2 = 0$

$x^2 - 2x + x - 2 = 0$

$x^2 - x - 2 = 0$

Therefore, $y = x^2 - x - 2$

**Hence, A is the right option**

# CHAPTER SIX

**Variation**

**Direct**

83.  The extension of a stretched string is directly proportional to its tension. If the extension produced by a tension of 8 Newton's is 2cm, find the extension produced by a tension of 12 newton's.

A. 2
B. 1
C. 0
D. 3
**UTME, 2015**

84.  If temperature t is directly proportional to heat h, and when t = 20°C, h = 50J, find t when h = 60J

A. 24°C
B. 20°C
C. 34°C
D. 30°C
**UTME, 2017**

**Inverse**

85. If P varies inversely as the square root of q, where p = 3 and q = 16, find the value of q when p = 4.

A. 12
B. 8
C. 9
D. 16
**UTME, 2019**

86. If w varies inversely as uv/(u+v) and w = 8 when u = 2 and v = 6, find a relationship between u, v, w.

A. $uvw = 16(u + v)$
B. $16uv = 3w(u + v)$
C. $uvw = 12(u + v)$
D. $12uvw = u + v$
**UTME, 2021**

**Joint**

87. If $N = p/2((T1-T2)/T1)$. Find P when N = 12, T1 = 27 and T2 = 24.

A. 48
B. 108
C. 54
D. 216
**UTME, 2016**

88. P varies jointly as m and u, and varies inversely as q. Given that p = 4, m = 3 and u = 2 and q = 1, find the value of p when m = 6, u = 4 and q =8/5

A. 12 8/5
B. 15
C. 10
D. 28 8/5
**UTME, 2013**

**Partial**

89. P varies directly as Q and inversely as R. When Q = 36 and R = 16, P = 27. Find the relation between P, Q and R.

A. P=Q/12R
B. P=12Q/R
C. P=12QR
D. P=12/QR
**UTME, 2014**

**Percentage Increase and Decrease.**

90. If 3 gallons of spirit containing 20% water is added to 5gallons of another spirit containing 15% water, what percentage of the mixture is water?

A. $2\frac{4}{5}\%$
B. $16\frac{7}{8}\%$
C. $18\frac{1}{8}\%$
D. $18\frac{7}{8}\%$
**UTME, 2020**

**ANSWERS**

**83.   SOLUTION**

Let the extension be E and the tension be T.

Then $(E \propto T)$

$(E = kT)$

when T = 8N, E = 2cm

$(2 = k \times 8)$

k = 2/8} = 0.25

∴E = 0.25T

when T = 12N; E = 0.25 × 12 = 3cm$)$

**Therefore, D is the right option**

**84.   SOLUTION**

$t \propto h$, t = 20, h

t = ? h = 60

t = kh where k is constant

20 = 50k

k = 20/50

k = 2/5

when h = 60, t = ?

t = 60 ×2/5 =24

**Therefore, A is the correct option**

**85.    SOLUTION**

$p \propto \frac{1}{q} = p = \frac{k}{\sqrt{q}}$

when p = 3, q = 16.

$3 = \frac{k}{\sqrt{16}}$

$k = 3 \times 4 = 12$

$\therefore p = \frac{12}{\sqrt{q}}$

when p = 4,

q = 9

**Therefore, C is the correct option**

**86.    SOLUTION**

$W \propto \frac{\frac{1}{uv}}{u+v}$

$\therefore w = \frac{\frac{k}{uv}}{u+v}$

$w = \frac{k(u+v)}{uv}$

w = 8, u = 2 and v = 6

$8 = \frac{k(2+6)}{2(6)}$

=K = 12; i.e 12 (u + v) = uwv

    **Therefore, the correct option is C**

**87.SOLUTION**

$N = \frac{p}{2}\left(\frac{T1-T2}{T1}\right)$

$12 = \frac{p}{2}\left(\frac{27-24}{27}\right)$

Make P subject of the formula;

P = 24 x 9 = 216

**Therefore, the right answer is D**

**88.    SOLUTION**

P ∝ mu, p ∝1/q

p = muk  (1)

p = (1/q)k(2)

Combining (1) and (2), we get

P = *(mu/q)k*

$4 = (m \times u/1)k$

giving k = 4/6 = 2/3

H, P = $(2 \times 6 \times 4 \times 5)/(3 \times 8)$

p = 10

**Therefore, C is the correct option**

**89.    SOLUTION**

P∝Q/R

P= K(Q/R)

When Q = 36, R = 16, P = 27

Then substitute into the equation

27=K(36/16)

K=$(27 \times 16)/36$

K= 12

So the equation connecting P, Q and R is

P=12Q/R

**Therefore, B is the correct option**

**90.     SOLUTION**

3 gallons − 20%

+

5 gallons − 15%

$= 3\left(\frac{20}{100}\right) + 5\,\frac{15}{100}$

$= \dfrac{3\left(\frac{20}{100}\right) + 5\,\frac{15}{100}}{3+5}$

$= \dfrac{\frac{60}{100} + \frac{75}{100}}{8} \times \dfrac{100}{1}$

$= \dfrac{0.6 + 0.75}{8} \times \dfrac{100}{1}$

$= \dfrac{1.35}{8} \times \dfrac{100}{1} = 16.875$

$= 16\,\dfrac{7}{8}\,\%$

**Therefore, the right option is B**

**CHAPTER SEVEN**

**Inequalities:**

**Analytical And Graphical Solutions of Linear Inequalities**

**91. Evaluate $3(x + 2) > 6(x + 3)$**

A. x < 4
B. x > -4
C. x < -4
D. x > 4
**UTME, 2013**

**92. Solve for x: $|x - 2| < 3$**

A. x < 5
B. -2 < x < 3
C. -1 < x < 5
D. x < 1
**UTME, 2013**

**93. Solve the inequality: $(2x-5)/2 < (2-x)$**

A. x > 0
B. x < 1/4
C. x > 21/2
D. x < 21/4
**UTME, 2013**

**94.** If 4sin² x−3=0, find the value of x, when 0° ≤ x ≤ 90°

A. 90°
B. 45°
C. 60°
D. 30°
**UTME, 2019**

**95.** List all integers satisfying the inequality in −2 < 2x−6 < 4

A. 2,3,4 and 5
B. 2,3
C. 2,5
D. 3,4
**UTME, 2021**

## ANSWERS

**91. SOLUTION**

$3(x + 2) > 6(x + 3)$

3x+6 > 6x +18

X < −4

**Therefore, C is the correct option**

**92. SOLUTION**

|x − 2| < 3

X+2 < 3 (Sign will change to positive because of the absolute sign)

X <3-2

X < 1

**Therefore, D is the right option**

**93. SOLUTION**

(2x-5)/2 < (2-x)

2x − 5 < 4 − 2x

4x < 9

X = $2\frac{1}{4}$

**Therefore, D is the right option**

**94.    SOLUTION**

$4sin^2 x - 3 = 0 \implies sin^2 x = \frac{3}{4}$ since sin $(x)$ is positive in the first quadrant

$\implies Sin(x) = \frac{\sqrt{3}}{2}$ hence $x = \sin^{-1}\frac{\sqrt{3}}{2} = 60°$

**Correct option is C**

## 95.    SOLUTION

−2 < 2x − 6   AND  2x − 6 < 4

−2 + 6 < 2x  AND  2x < 4 + 6

4 < 2x  AND  2x < 10

 2 < x  AND x < 5

2 < x < 5

As 3 and 4

**Therefore, correct option is D**

## CHAPTER EIGHT

**Progression:**

**nth term of a Progression**

96.  If $U_n = n(n^2 + 1)$, evaluate $U_5 - U_4$

A. 18
B. 56
C. 62
D. 80
**UTME, 2013**

97. The 4th term of an A.P. is 13 while the 10th term is 31. Find the 24th term.

A. 89
B. 75
C. 73
D. 69
**UTME, 2014**

98.  The first and last term of a linear sequence (AP) are 6 and 10 respectively. If the sum of the sequence is 40. Find the number of terms

A. nth = 3
B. nth = 4
C. nth = 5
D. nth = 6
**UTME, 2015**

**99.** If the 2nd term of a G.P is 8/9 and the 6th term is 4½. Find the common ratio.

A. 2
B. 3/2
C. ⅔
D. 3
**UTME, 2016**

**100.** What is the n-th term of the sequence 2, 6, 12, 20...?

A. $4n - 2$
B. $2(3^{n-1})$
C. $n^2 + n$
D. $n^2 + 3n + 2$
**UTME, 2021**

**Sum of A. P. and G. P.**

**101.** If the sum of the first two terms of a G.P. is 3, and the sum of the second and the third terms is -6, find the sum of the first term and the common ratio

A. -2
B. -3
C. -5
D. 5
**UTME, 2013**

**102.** The nth term of a sequence is given by $2^{2n-1}$. Find the sum of the first four terms.

A. 74

B. 32

C. 42

D. 170

**UTME, 2019**

**ANSWER**

**96. SOLUTION**

$U_n = n(n^2 + 1)$

$U^5 = 5(5^2 + 1)$

$= 5(25 + 1)$

$= 5(26) = 130$

$U^4 = 4(4^2 + 1) = 4(16 + 1)$

$= 4(17) = 68$

$U5 - U4 = 130 - 68 = 62$

**The right option is C**

**97. SOLUTION**

$T_4 = a + (n-1)d = 13$ ------eqn (1)

$T_{10} = a + (n-1)d = 31$ -------eqn (2)

$a + (4-1)d = 13 = a + 3d = 13$

$a + (10-1)d = 31 = a + 9d = 31$

$a + 3d = 13$    (By applying elimination method)

$a + 9d = 31$

--------------

$-6d = -18$

$\therefore d = 3$

By substituting the value for d into eqn 1 to get a;

$a + (n-1)d = 13$

$a + (4-1)3 = 13 = a + (3)3 = 13$

$a + 9 = 13$

$a = 13-9 = 4$

$\therefore$ T$_{24}$ = a + (n–1)d
T$_{24}$ = 4 + (24–1)3
T$_{24}$ = 4 + (23)3
T$_{24}$ = 4 + 69 = 73
**The right option is C**

**98.    SOLUTION**
nth term of an AP = a+(n – 1)d
first term = 6, last term = 10 sum = 40
i.e. a = 6, l = 10, S = 40
Sn= n/2(2a + (n – 1)d or Sn = ÷2 (a + l)
Sn = n/2(a + l)
40 = n/2(6 + 10)
40 = 8n
8n = 40
8n = 40
n = 40/8
= 5
The number of terms = 5

**99.    SOLUTION**
Formular for G.P = ar$^{n-1}$
T$_2$ = ar$^{n-1}$ = 8/9 ------ eqn (1)
T$_6$ = ar$^{n-1}$ = 4½ = 9/2 ----- eqn (2)
ar$^{2-1}$ = $\frac{8}{9}$ = ar = $\frac{8}{9}$
ar$^{6-1}$ = $\frac{9}{2}$ = ar$^5$ = $\frac{9}{2}$
a$_1$ = $\frac{8}{9r}$ substitute into the next eqn
$\frac{8}{9r} \cdot r^5$ = $\frac{9}{2}$
= $\frac{8}{9} \cdot r^4$ = $\frac{9}{2}$
= r$^4$ = $\frac{9}{2} \times \frac{9}{8}$ = $\frac{81}{16}$

$r = \sqrt[4]{\frac{81}{16}} = \frac{3}{2}$

**The right option is B**

### 100.   SOLUTION

Given that 2, 6, 12, 20...? the nth term = $n^2 + n$

check: n = 1, $u1$ = 2

n = 2, $u2$ = 4 + 2 = 6

n = 3, $u3$ = 9 + 3 = 12

∴ n = 4, $u4$ = 16 + 4 = 20

**Therefore, correct option is C**

### 101.   SOLUTION

$S_n = a(\frac{r^n - 1}{r - 1})$

The sum of first two terms is 2

$S_n$ = 3

$S_n = 3a(\frac{r^n - 1}{r - 1})$

Cross multiply

$3(r-1) = a (r^2 - 1)$

By simplifying we have

$Ar^2 - 3r - a = -3$  eqn 1

$U_n = ar^n - 1$

$U_2 = ar^2 - 1 = ar$

$U_3 = ar^3 - 1 = ar^2$

$ar + ar^2 = -6$          eqn 2

from eqn 2,

$a = \frac{-6}{r+r^2}$

Substituting the above eqn into eqn 1 we have;

$(\frac{-6}{r+r^2})r^2 - 3r - (\frac{-6}{r+r^2}) = 3$

By simplifying and equating to 0

$3r^3 - 3r^2 + 3r^2 + 6r^2 - 3r - 6 = 0$

$= 3r^3 + 6r^2 - 3r - 6 = 0$

Factorise

$3(r^3 + 2r^2 - r - 2) = 0$

$r + 2 = 0, r = -2$

substituting the value of r into eqn 2

$a = \frac{-6}{r+r^2}$

$= a = \frac{-6}{(-2)+(-2)^2} = \frac{-6}{2} = -3$

Since $r = -2$ and $a = -3$

Sum of the first and common ratio is;

$-2 - 3 = -5$

**Therefore, the correct answer is C**

## 102.   SOLUTION

The nth of a sequence is $2^{2n-1}$

$T1 = 2^{2n-1} = 2^{2(1)-1} = 2$

$T2 = 2^{2n-1} = 2^{2(2)-1} = 8$

$T3 = 2^{2n-1} = 2^{2(3)-1} = 32$

$T4 = 2^{2n-1} = 2^{2(4)-1} = 128$

Therefore, sum of the first four terms;

$T1 + T2 + T3 + T4 = 2 + 8 + 32 + 128$

$= 170$

**Therefore, the correct answer is D**

# CHAPTER NINE

**Binary Operations**

**103.** **If a binary operation * is defined by x * y = x + 2y, find 2 * (3 * 4)**

A. 24
B. 16
C. 14
D. 26
**UTME, 2013**

**104.** **If m * n = [mn - nm] for m, n belong to R, evaluate - 3 * 4**

A. 3
B. 4
C. 5
D. 6
**UTME, 2017**

**105.** **A binary operation ⊗ is defined by m⊗n=mn+m-n on the set of real numbers, for all m, n ∈ R. Find the value of 3 ⊗ (2 ⊗ 4).**

A. 6
B. 25
C. 15
D. 18
**UTME, 2019**

**106.** If the binary operation ∗ is defined by m ∗ n = mn + m + n for any real number m and n, find the identity of the elements under this operation

A. e = 1
B. e = −1
C. e = −2
D. e = 0
**UTME, 2021**

**ANSWERS**

**103. SOLUTION**

x * y = x + 2y (given)

3 *4 = 3 + 2(4) = 11

Hence, 2 * (3 * 4) = 2 × 11

= 2 + 2(11)

= 2 + 22

= 24

**Therefore, the right answer is A**

**104. SOLUTION**

m * n = m/n – m/n

m = – 3

n = 4

∴ – 3 × 4 = –3/4 –(–4/–3)

= 3(–3)–(–4×4)/12

= –9+16/12

= 7/12

**Therefore, C is the right Option**

**105. SOLUTION**

m ⊗ n = mn + m – n)

3 ⊗ (2 ⊗ 4)

2 ⊗4 = 2(4) + 2 – 4 = 6

3 ⊗ 6 = 3(6) + 3 – 6  = 15

**Therefore, the right option is C**

**106. SOLUTION**

Identity $(e)$ : $a * e = a$

$m * e = m...(i)$

$m * e = me + m + e$

Because $m * e = m$

$: m = me + m + e$

$m - m = e(m + 1)$

$e = \frac{0}{m+1}$

$e = 0$

**Therefore, D is the right Option**

# CHAPTER TEN

## Matrices and Determinants

## Algebra Of Matrices Not Exceeding 3 X 3

**107.** **Find 2P + Q**

If $P = \begin{pmatrix} 5 & 3 \\ 2 & 1 \end{pmatrix}$ and $Q = \begin{pmatrix} 4 & 2 \\ 3 & 5 \end{pmatrix}$, find 2P + Q

A. $\begin{vmatrix} 7 & 7 \\ 14 & 8 \end{vmatrix}$

B. $\begin{vmatrix} 14 & 8 \\ 7 & 7 \end{vmatrix}$

C. $\begin{vmatrix} 7 & 7 \\ 8 & 14 \end{vmatrix}$

D. $\begin{vmatrix} 8 & 14 \\ 7 & 7 \end{vmatrix}$

**UTME, 2013**

**108.** **Find y, if**

$$\begin{pmatrix} 5 & -6 \\ 2 & -7 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} 7 \\ -11 \end{pmatrix}$$

A. 8
B. 5
C. 3
D. 2

**UTME, 2014**

**Determinants Of Matrices Not Exceeding 3 X 3**

**109.**

$$\text{If} \begin{vmatrix} -x & 12 \\ -1 & 4 \end{vmatrix} = -12, \text{ find x}$$

A. −6
B. −2
C. 3
D. 6
**UTME, 2014**

**110.  Find x**

$$\text{If} \begin{vmatrix} 2 & -4 \\ x & 9 \end{vmatrix} = 58, \text{ find the value of x.}$$

A. 10
B. 30
C. 14
D. 28

**111.   Find M$^T$ + 2M**

Given matrix M = $\begin{vmatrix} -2 & 0 & 4 \\ 0 & -1 & 6 \\ 5 & 6 & 3 \end{vmatrix}$, find

$M^T + 2M$

A. $\begin{vmatrix} -4 & 2 & 1 \\ 6 & 0 & 5 \\ 0 & 6 & 2 \end{vmatrix}$

B. $\begin{vmatrix} -6 & 0 & 13 \\ 0 & -3 & 18 \\ 14 & 18 & 9 \end{vmatrix}$

C. $\begin{vmatrix} 5 & 2 & 6 \\ 0 & 1 & 1 \\ 3 & 4 & -7 \end{vmatrix}$

D. $\begin{vmatrix} -4 & 0 & 8 \\ 0 & -2 & -16 \\ 10 & 12 & 6 \end{vmatrix}$

**UTME, 2019**

# ANSWERS

**107. SOLUTION**

2P +Q

$$2\begin{pmatrix} 5 & 3 \\ 2 & 1 \end{pmatrix} + \begin{pmatrix} 4 & 2 \\ 3 & 5 \end{pmatrix} = \begin{pmatrix} 14 & 8 \\ 7 & 7 \end{pmatrix}$$

**Therefore, B is the correct option**

**108. SOLUTION**

$0 + 1\big((3 \times 4) - (5 \times 2)\big) + 0$

$= 2$

**Therefore, D is the correct option**

**109. SOLUTION**

$-4x - (-12) = -12$

$-4x + 12 = -12$

$-4x = -24$

$X = 6$

**Therefore, the correct option is D**

**110. SOLUTION**

$18 - (-4x) = 58$

$18 + 4x = 58$

$X = 10$

**Therefore, A is the correct option**

**111.    SOLUTION**

$$M = \begin{pmatrix} -2 & 0 & 4 \\ 0 & -1 & 6 \\ 5 & 6 & 3 \end{pmatrix} = M^T = \begin{pmatrix} -2 & 0 & 5 \\ 0 & -1 & 6 \\ 4 & 6 & 3 \end{pmatrix} + 2\begin{pmatrix} -2 & 0 & 4 \\ 0 & -1 & 6 \\ 5 & 6 & 3 \end{pmatrix}$$

$$\begin{pmatrix} -6 & 0 & 13 \\ 0 & -3 & 18 \\ 14 & 18 & 9 \end{pmatrix}$$

**Therefore, B is the right option**

# CHAPTER ELEVEN

**GEOMETRY AND TRIGONOMETRY**
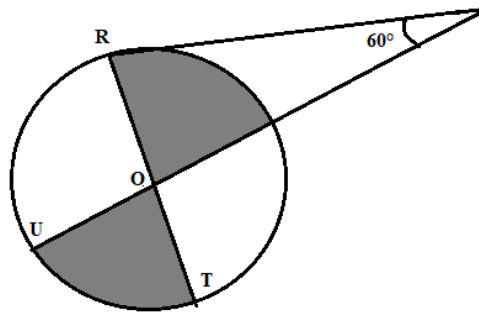


**Euclidean Geometry**
**Polygons: Triangles, Quadrilaterals And General Polygons**

**112.** **How many sides has a regular polygon whose interior angle is 135°?**

A. 12
B. 10
C. 9
D. 8
**UTME, 2014**

**113.** **In a regular polygon, each interior angle doubles its corresponding exterior angle. Find the number of sides of the polygon**

A. 8
B. 6
C. 4
D. 3
**UTME, 2017**

114.   The sum of the interior angles of a polygon is a given as 1080. Find the number of the sides of the polygon.

A. 5
B. 7
C. 6
D. 8
**UTME, 2016**

**Circles: Angle Properties, Cyclic Quadrilaterals And Intersecting Chords**
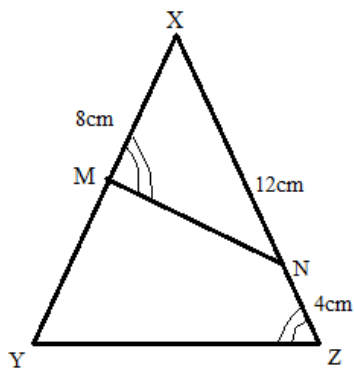


115.   From the diagram above. Find the fraction of the shaded position?

A. 1/3
B. 1/5
C. 1/4
D. 1/6
**UTME, 2016**

**116.** Find the equation of the tangent at the point $(2, 0)$ to the curve $y = x^2 - 2x$

A. $y = 2x - 4$
B. $y = 2x + 4$
C. $y = 2x - 2$
D. $y = 2x + 2$
**UTME, 2018**

**Mensuration**

**Lengths And Areas Of Plane Geometrical Figures**

**117.** In the figure below, $/MX/ = 8cm$, $/XN/ = 12cm$, $/NZ/ = 4cm$ and $\angle XMN = \angle XZY$. Calculate $/YM/$

A. 32cm
B. 24 cm
C. 16 cm
D. 12 cm
**UTME, 2018**

**118.** Find the length of a side of a rhombus whose diagonals are 6cm and 8cm

A. 8cm
B. 5cm
C. 4cm
D. 3cm
**UTME, 2021**

## Lengths Of Arcs And Chords Of A Circle

**119.** An arc of the length 16πcm subtends an angle of 80° at the centre of the circle. Find the radius of the circle.

A. 24cm
B. 28cm
C. 36cm
D. 32cm
**UTME, 2016**

**120.** An arc of a circle of radius 14cm subtends angle 300° at the centre. Find the perimeter of the sector formed by the arc (take π = 22/7)

A. 14.67cm
B. 73.33 cm
C. 101.33cm
D. 513.33cm
**UTME, 2018**

## Perimeters And Areas Of Sectors And Segments Of Circles

**121.** If the angle of a sector of a circle with radius 10.5 cm is 120°, find the perimeter of the sector. [Take π=22/7]

A. 48 cm
B. 40 cm
C. 43 cm
D. 45 cm
**UTME, 2014**

**122.** **Calculate the perimeter of a sector of a circle of raduis 12cm and angle 60°.**

A. $(12 + 4\pi)$cm
B. $(24 + 4\pi)$cm
C. $(12 + 6\pi)$cm
D. $(24 + 6\pi)$cm
**UTME, 2016**

**123.** **Calculate the perimeter of a sector of a circle of raduis 9cm and angle 36°.**

A. 18cm
B. $(18 + 9/5\pi)$cm
C. $(9 + 9/5\pi)$cm
D. $9\pi5$cm
**UTME, 2016**

**124.** **P$(-6, 1)$ and Q$(6, 6)$ are the two ends of the diameter of a given circle. Calculate the radius.**

A. 6.5 units
B. 13.0 units
C. 3.5 units
D. 7.0 units
**UTME, 2021**

**125.** The angle of a sector of a circle, radius 10.5cm, is 48°, Calculate the perimeter of the sector

A. 8.8cm
B. 25.4cm
C. 25.6cm
D. 29.8cm
**UTME, 2021**

## Surface Areas And Volumes Of Simple Solids And Composite Figures

**126.** A cylindrical tank has a capacity of 6160m³. What is the depth of the tank if the radius of its base is 28cm?

A. 8.0m
B. 7.5m
C. 5.0m
D. 2.5m
**UTME, 2014**

**127.** Find the total surface area of a cylinder of base radius 5cm and length 7cm ( $\pi = 3.14$ )

A. 17.8cm²
B. 15.8cm²
C. 75.4cm²
D. 54.7cm²
E. 377.1cm²
**UTME, 2015**

**128.   A pipe made of metal 10cm thick has an external radius of 11cm. find the area of metal in making 2.4cm of pipe**

A. $24\pi cm^2$

B. $21\pi cm^2$

C. $15\pi cm^2$

D. $17\pi cm^2$

**UTME, 2015**

**129.   The volume of a cylinder whose height is 4cm and whose radius 5cm is equal to ($\pi$ = 3.14)**

A. $3.13cm^3$

B. $145cm^3$

C. $314cm^3$

D. $214cm^3$

**UTME, 2015**

**130.   Find the area of the curved surface of a cone whose base radius is 3cm and whose height is 4cm ($\pi$ = 3.14)**

A. $17.1cm2$

B. $27.2cm2$

C. $47.1cm2$

D. $37.3cm2$

**UTME, 2015**

**Loci**

**locus in 2 dimensions based on geometric principles relating to lines and curves.**

**131.  The locus of a point which is equidistant from the line PQ forms a**

A. circle centre P
B. pair of parallel lines each opposite to PQ
C. circle centre Q
D. perpendicular line to PQ
**UTME, 2017**

**132.  Find the equation of the locus of a point p $(x, y)$ such that pv = pw, where v= $(1, 1)$ and w = $(3, 5)$**

A. 2x + 2y = 9
B. 2x + 3y = 8
C. 2x + y = 9
D. x + 2y = 8
**UTME, 2017**
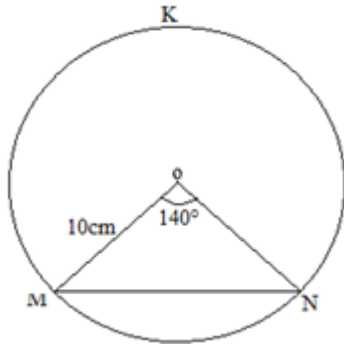
**133.** **In the diagram above MN is a chord of a circle KMN centre O and radius 10cm. If < MON = 140°, find, to the nearest cm, the length of the chord MN.**

A. 10cm

B. 19cm

C. 17cm.

D. 12cm

**UTME, 2017**

**134.** **The locus of a point which moves so that it is equidistant from two intersecting straight lines is the**

A. bisector of the two lines

B. line parallel to the two lines

C. angle bisector of the two lines

D. perpendicular bisector of the two lines

**UTME, 2019**

**135.** Find the equation of the locus of a point $A(x, y)$ which is equidistant from $B(0, 2)$ and $C(2, 1)$

A. 4x + 2y = 3
B. 4x – 3y = 1
C. 4x – 2y = 1
D. 4x + 2y = –1
**UTME, 2019**

**136.** The locus of a point which moves so that it is equidistant from two intersecting straight lines is the?

A. perpendicular bisector of the two lines
B. angle bisector of the two lines
C. bisector of the two lines
D. line parallel to the two lines
**UTME, 2021**

**Coordinate Geometry**

**Midpoint And Gradient Of A Line Segment**

**137.** The gradient of a line joining $(x,4)$ and $(1,2)$ is ½. Find the value of x

A. 5
B. 3
C. –3
D. –5
**UTME, 2014**

138. **Calculate the mid point of the line segment y - 4x + 3 = 0, which lies between the x-axis and y-axis.**

**UTME, 2014**

## Distance Between Two Points.

139. **Find the distance between the points (-2,-3) and (-2,4)**

A. 3m
B. 2.4m
C. 3.2m
D. 7m
**UTME, 2015**

140. **A trapezium has two parallel sides of length 5cm and 9cm. If the area is 91cm22, find the distance between the parallel sides**

A. 13 cm
B. 4 cm
C. 6 cm
D. 7 cm
**UTME, 2021**

## Parallel And Perpendicular Lines.

141. **If line p = 5x + 3 is parallel to line p = wx + 5. Find the value of w.**

A. 7
B. 3
C. 6
D. 5
**UTME, 2016**

**142.** find the value of p if the line which passes through (-1, -p) and (-2,2) is parallel to the line 2y+8x-17=0?

A. -2/7
B. 7/6
C. -6/7
D. 2
**UTME, 2021**

**Equations Of Straight Lines.**

**143.** Find the equation of the straight line through (-2, 3) and perpendicular to 4x + 3y - 5 = 0

A. 3x - 4y + 18 = 0
B. 3x + 2y - 18 = 0
C. 4x + 5y + 3 = 0
D. 5x - 2y - 11 = 0
**UTME, 2014**

**144.** If given two points A(3, 12) and B(5, 22) on a x-y plane. Find the equation of the straight line with intercept at 2.

A. y = 5x + 2
B. y = 5x + 3
C. y = 12x + 2
D. y = 22x + 3
**UTME, 2019**

**Trigonometry**

**Trigonometrical Ratios Of Angles**
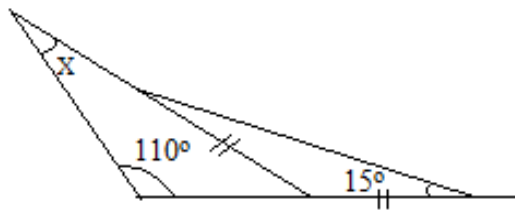


**145.  In the diagram given, find the value of x.**

A. 30°
B. 40°
C. 45°
D. 15°
**UTME, 2013**
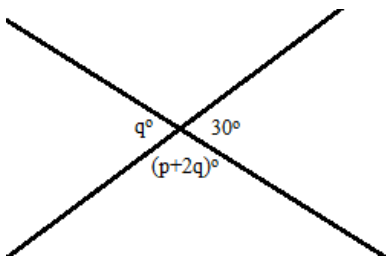


**146.  From the figure above, what is the value of p?**

A. 135°
B. 90°
C. 60°
D. 45°

**UTME, 2014**
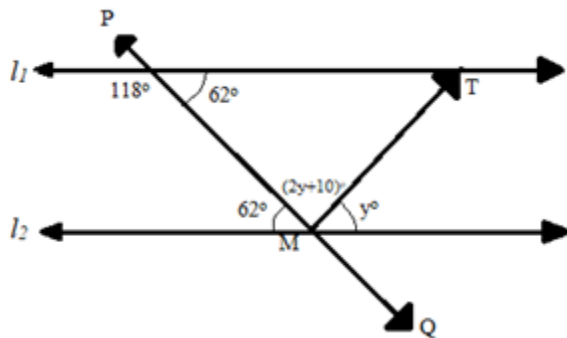


**147.   In the diagram above, l₁ is parallel to l₂, Find the value of < PMT**

A. 82°

B. 36°

C. 72°

D. 118°

**UTME, 2016**

## Areas And Solutions Of Triangle
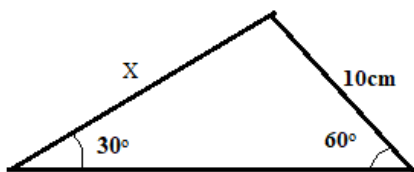


**148.   Find the value of x in the figure above**

A. 203√cm

B. 103√cm
C. 53√cm
D. 43√cm
**UTME, 2014**

# ANSWERS

### 112. SOLUTION

If each interior angle of the polygon is 135º, then each exterior angle is 180º – 135º = 45º. therefore, number of sides = 360º/one exterior angle

360º/45º = 8

**Therefore, D is the right option**

### 113. SOLUTION

2x + x = 180º

3x = 180º

x = 60º (exterior angle of the polygon)

angle = total angle/number of sides

60 = 360/n

n = 360/60

n = 6 sides

**Therefore, the right answer is B**

### 114. SOLUTION

Sum of interior angles = 180(n − 2)

Where n = number of sides.

Hence, we have:

1080 = 180(n − 2)

(n − 2) = 1080/180

n − 2 = 6

therefore, n = 6 + 2 = 8

the polygon has 8 sides

**Therefore, D is the right option**

**115.    SOLUTION**

$\theta = 180° - (90 + 60)$

$\theta = 180° - 150° = 30°$

Fraction of shaded position = 30/360 + 30/360

= 1/12 + 1/12 = 1/6

**Therefore, D is the right option**

**116.    SOLUTION**

The gradient to the curve is found by differentiating the curve equation with respect to x So dy/dx 2x – 2

The gradient of the curve is the same with that of the tangent.

At point $(2, 0)$ dy/dx = 2(2) – 2

= 4 – 2 = 2

The equation of the tangent is given by $(y - y_1)$ dy/dx $(x – x_1)$

At point $(x_1, y_1) = (2, 0)$

$y - 0 = 2(x - 2)$

$y = 2x - 4$

**Therefore, the correct option is A**

**117.    SOLUTION**

From the figure, $\angle$ XMN = $\angle$ XZY

Angle X is common

So, $\angle$ XNM = $\angle$ XYZ

Then from the angle relationship

XM/XZ = XN/XY = MN/ZY

XM = 8, XZ = 12 + 4 = 16,

XN = 12, XY = 8 + YM

8/16 = 12/(8+YM)

Cross multiply

8(8 + YM) = 192

64 + 8YM = 192

8YM = 128

YM = 16cm

**Therefore, C is the right option**

**118.   SOLUTION**

The diagonal of a rhombus is a line segment that joins any two non-adjacent vertices.

A rhombus has two diagonals that bisect each other at right angles.

i.e this splits 6cm into 3cm each AND 8cm to 4cm

Using $Hyp^2 = adj^2 + opp^2$

$Hyp^2 = 3^2 + 4^2$

$Hyp^2 = 25$

$Hyp = 5$

$\therefore$ Length (L) is 5cm because a rhombus is a quadrilateral with 4 equal lengths

**Therefore, the correct option is B**

**119.   SOLUTION**

Length of arc = $\theta/360 \times 2\pi r$

$16\pi = 80/360 \times 2\pi r$

$16\pi \times 360/80 \times 2\pi = r$

r = 36cm

**Therefore, C is the correct option**

**120.   SOLUTION**

Length of the arc = $\theta/360$ x 2πr

= 300/360×2×22/7×14

= 220/3 = 73.33 cm

Perimeter of the sector = $\theta/360$ x 2πr + 2r

= 73.33 + 2(14)

= 101.33 cm

**Therefore, C is the correct option**

**121.   SOLUTION**

Perimeter of the sector = 2r+$\theta/360°$×2πr

= 2(10.5)+120/360×2×22/7×10.5

= 21+22 = 43 cm

**Therefore, C is the correct option**

**122.   SOLUTION**

Perimeter = 2r + $\theta/360$ x 2πr

= 2(12) + 6/0360 x 2 x π x 12

= (24 + 4π)cm

**Therefore, B is the correct option**

**123.   SOLUTION**

Perimeter = 2r + $\theta/360$ x 2πr

2(9) + 36/360 x 2 x π x 9 = (18 + 9/π5)cm

**Therefore, B is the correct option**

**124.  SOLUTION**

$PQ^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

$= 12^2 + 5^2$

$= 144 + 25$

$= 169$

$PQ = \sqrt{169} = 13$

But PQ = diameter = 2r, r = PQ/2 = 6.5 units

**Therefore, the correct option is A**


**125.  SOLUTION**

Length of Arc AB = $\theta/360 \ 2\pi r$

$= 48/360 \times 2 (22/7) \times 21/2$

$= \frac{4\times22\times\times3}{30}$ = 8.8cm

Perimeter = 8.8 + 2r

$= 8.8 + 2(10.5)$

$= 8.8 + 21$

$= 29.8cm$

**Therefore, the correct option is D**


**126.  SOLUTION**

Using $V = \pi r^2 h$

$6160 = 22/7 \times 28 \times 28 \times h$

$h = 6160/(22\times4\times28)$

$h = 2.5m$

**Therefore, D is the correct option**

### 127. SOLUTION

The total surface area of a cylinder = $2\pi rl + 2\pi r^2$

= $2\pi r(l + r)$

= $2 \times 3.14 \times 5(7+5)$

$2 \times 3.14 \times 12 \times 5$

= 377.1cm (1 d.p)

**Therefore, E is the correct option**

### 128. SOLUTION

The external radius = 11cm

The internal radius = 10cm

The area of cross section = $\pi(\pi^2 - 10^2)$

= $\pi(11 + 10)(11 - 10)$

= $\pi(21)(1)$

= $21\pi$cm$^2$

**Therefore, B is the correct option**

### 129. SOLUTION

$V = \pi r^2 h$

V = ?, h = 4cm, r = 5cm

$V = 3.14(5)^2(4)$

$V = 3.14(25)(4)$

$V = 3.14 \times 100 = 314$cm$^2$

**Therefore, C is the correct option**

### 130. SOLUTION

$l^2 = h^2 + r^2$ (h=4cm,r=3cm)l2=h2+r2(h=4cm,r=3cm

$l^2 = 4^2 + 3^2 = 16 + 9 = 25$

$l^2 = \sqrt{25}$

Squaring both sides

l = 5cm

The area of curved surface $(s) = \pi(3)(5)$

$15\pi = 15 \times 3.14 = 47.1 cm^2$

**Therefore, C is the correct option**

### 131. SOLUTION

The locus of points at a fixed distance from the point P is a circle with the given P at its centre.

The locus of points at a fixed distance from the point Q is a circle with the given point Q at its centre.

The locus of points equidistant from two points P and Q i.e line PQ is the perpendicular bisector of the segment determined by the points

Hence, The locus of a point which is equidistant from the line PQ forms a perpendicular line to PQ.

**Therefore, D is the correct option**

### 132. SOLUTION

The locus of a point p $(x, y)$ such that pv = pw where v = $(1, 1)$

and w = $(3, 5)$. This means that the point p moves so that its distance from v and w are equidistance.

$\sqrt{(x - x1)2} + (y - y1)2 = \sqrt{(x - x2)2 + (y - y2)2}$

$\sqrt{(x - 3)2 + (y - 5)2}$

square both sides

$(x - 1)^2 + (y - 1)^2 = (x - 3)^2 + (y - 5)^2$

$x^2 - 2x + 1 + y^2 - 2y + 1 = x^2 - 6x + 9 + y^2 - 10y + 25$

$x^2 + y^2 - 2x - 2y + 2 = x^2 + y^2 - 6x - 10y + 34$

Collecting like terms

$x^2 - x^2 + y^2 - y^2 - 2x + 6x - 2y + 10y = 34 - 2$

$= 4x + 8y = 32$

Divide through by 4

$x + 2y = 8$

**Therefore, the right option is D**

### 133. SOLUTION

From the diagram

$\sin 70^\circ = x/10$

$x = 10\sin 70^\circ$

$= 9.3969$

Hence, length of chord MN = 2x

$= 2 \times 9.3969$

$= 18.7938 = 19cm \text{ (nearest cm)}$

**Therefore, the correction option is B**

### 134. SOLUTION

Locus is the path traced at by a point which moves in accordance with a certain law. It is also the set of all possible position occupied by an object

The path traced from all possible location of 4cm from a given point P form a circle of radius 4cm with centre P.

**Therefore, the correction option is B**

### 135. SOLUTION

Since $A(x, y)$ is the point of equidistance between B and C, then

AB = AC

$(AB)^2 = (AC)^2$

Using the distance formula,

$(x - 0)^2 + (y - 2)^2 = (x - 2)^2 + (y - 1)^2$

$x^2 + y^2 - 4y + 4 = x^2 - 4x + 4 + y^2 - 2y + 1$

$4x - 2y = 1$

**Therefore, the correction option is C**

### 136. SOLUTION

The required locus is angle bisector of the two lines

**Therefore, correct option is C**

### 137. SOLUTION

Gradient m=y2-y1/x2-x1

1/2=2-4/1-x

$1 - x = 2(2 - 4)$

$1 - x = 4 - 8$

$1 - x = -4$

$-x = -4 - 1$

$x = 5$

**Therefore, the correction option is A**

**138.  SOLUTION**

y − 4x + 3 = 0

When y = 0, 0 − 4x + 3 = 0

Then -4x = -3

x = 3/4

So the line cuts the x-axis at point $(3/4, 0)$.

When x = 0, y − 4$(0)$ + 3 = 0

Then y + 3 = 0

y = -3

So the line cuts the y-axis at the point $(0, -3)$

Hence the midpoint of the line y − 4x + 3 = 0, which lies between the x-axis and the y-axis is;

$(1/2(x1 + x2),\ 1/2(y1 + y2))$

$(1/2(3/4+ 0), 1/2(0 + -3))$

$([1/2(3/4), 1/2(-3))$

$(3/8, -3/2)$

**Therefore, the correction option is A**


**139.  SOLUTION**

Formula for calculating distance between two points;

$\sqrt{((x_2 - x_1)^2 + (y_2 - y_1)^2)}$

Points = $(-2,-3)$ and $(-2,4)$

Point 1 = $(x_1, y_1) = (-2,-3)$

Point 2 = $(x_2, y_2) = (-2,4)$

$= \sqrt{((-2 - (-2))^2 + (4 - (-3)^2)}$

$= \sqrt{((0)^2 + (7)^2)}$

$= \sqrt{(7)^2}$

= 7

**The correct option is D**

**140.   SOLUTION**

Area of Trapezium = $1/2(a+b) \times h$

$91 = 1/2 (5 + 9)h$

cross multiply

$91 = 7h$

$h = 91/7$

$h = 13cm$

**The correct option is A**

**141.   SOLUTION**

$P = 5x + 3, P = wx + 5$

$M_1 = 5, M_2 = w$

$M_1 = M_2$ (parallel lines)

$w = 5$

**Therefore, the correction option is D**

**142.   SOLUTION**

Line:  $2y+8x-17=0$

recall $y = mx + c$

$2y = -8x + 17$

$y = -4x + \frac{17}{2}$

Slope $m1 = 4$

parallel lines: $m1. m2 = -4$

where Slope $(-4) = \frac{y2-y1}{x2-x1}$ at points $(-1, -p)$ and $(-2,2)$

$-4(x2-x1) = y2-y1$

$-4 (-2 - -1) = 2 - -p$

$p = 4 - 2 = 2$

**Therefore, the correct option is D**

### 143. SOLUTION

$4x + 3y - 5 = 0$ (given)

The equation of the line perpendicular to the given line takes the form $3x - 4y = k$

Thus, substitution $x = -2$ and $y = 3$ in $3x - 4y = k$ gives;

$3(-2) - 4(3) = k$

$-6 - 12 = k$

$k = -18$

Hence the required equation is $3x - 4y = -18$

$3x - 4y + 18 = 0$

**Therefore, the correct option is A**

### 144. SOLUTION

The equation of a straight line is given as $y = mx + b$

where $m$ = the slope of the line; $b$ = intercept

Given points $A(3, 12)$ and $B(5, 22)$, the slope = $22 - 12/5 - 3$

$= 10/2 = 5$

Hence, the equation of the line is $y = 5x + 2$

**Therefore, A is the right option**

### 145. SOLUTION

In the diagram above, $< CDE = < CED = 15°$

(base $<$ s of isos. $\triangle$)

$< ECD = 180° - (15 + 15)°$

$= 180° - 30° = 150°$

But $x + 110° = 150°$

(Sum of opp. interior $<$ s of a$\triangle$ = opp. exterior $<$ )

$x = 150° - 110° = 40°$

**Therefore, the right option is B**

### 146. SOLUTION

In the figure above, $q° = 30°$ (vertically opposite angles)
$(P + 2q)° + 30° = 180°$ (angles on a straight line)
$p + 2 \times 30° + 30° = 180°$
$p + 60° + 30° = 180°$
$p + 90° = 180°$
$p = 180° - 90° = 90°$
**The correct option is B**

### 147. SOLUTION

$< MPT = 180° - 118° = 62°$
$< PML = 62°$ (Alternating angles)
$y + 2y + 10° + 62° = 180°$ (Angles on a straight line)
$3y = 180 - 72$
$3y/3 = 108/3$
$y = 36°$
$< PMT = 2y + 10 = 2(36) + 10 = 82°$
**The correct option is A**

### 148. SOLUTION

In the figure above, $(x/\sin 60°\} = 10/\sin 30°)$ (Using the Sine rule)
$x = 10\sin 60°/\sin 30°$
$= 10 \times (\sqrt{3}/2 \times 1/2)$
$= 10\sqrt{3}\text{cm}$

**The correct option is B**

**CHAPTER TWELVE**

**CALCULUS**

**Differentiation Of Explicit Algebraic And Simple Trigonometrical Functions-Sine, Cosine And Tangent.**

**149.   If y = x sin x, find δy/δx**

A. sin x – cos x
B. cos x – x sin x
**C. xcos x + x sin x**
D. sin x + xsin cos x
**UTME, 2013**


**150.   If y = 4x³ – 2x² + x, find δy/δx**

A. 8x² – 2x + 1
B. 8x² – 4x + 1
C. 12x² – 2x + 1
D. 12x²– 4x + 1
**UTME, 2014**


**151.   If y = cos 3x, find δy/δx**

A. ⅓sin3x
B. –⅓sin3x

C. 3 sin 3x
D. -3 sin 3x
**UTME, 2014**

**152.   If y = 2x³ + 6x² + 6x + 1, Find dy/dx**

A. $6x^2 + 12x + 1$
B. $6x^2 + 6x + 1$
C. $6x^2 + 6x + 6$
D. $6x^2 + 12x + 6$
**UTME, 2016**

**153.   If y = x Sin x, find dy/dx when x = π/2**

A. $-\pi/2$
B. -1
C. 1
D. $\pi/2$
**UTME, 2017**

**154.   If y=6x³ + 2x⁻² −x⁻³, find dy/dx.**

A. $dy/dx = 15x^2 - 4x^{-2} - 3x^{-2}$
B. $dy/dx = 6x + 4x^{-1} - 3x^{-4}$
C. $dy/dx = 18x^2 - 4x^{-3} + 3x^{-4}$
D. $dy/dx = 12x^2 + 4x^{-1} - 3x^{-2}$
**UTME, 2019**

**155.** Find the derivative of the function $y = 2x^2(2x - 1)$ at the point $x = -1$?

A. 18
B. 16
C. -4
D. -6
**UTME, 2021**

**Application of differentiation**

**156.** The radius of a circle is increasing at the rate of 0.02cms-1. Find the rate at which the area is increasing when the radius of the circle is 7cm.

A. $0.75cm^2S^{-1}$
B. $0.53cm^2S^{-1}$
C. $0.35cm^2S^{-1}$
D. $0.88cm^2S^{-1}$
**UTME, 2013**

**157.** If a car travels 120km on 45 litres of petrol, how much petrol is needed for a journey of 600km?

A. 720 litres
B. 160 litres
C. 225 litres
D. 960 litres
**UTME, 2016**

**158.** A man covered a distance of 50 miles on his first trip, on a later trip he traveled 300 miles while going 3 times as fast. His new time compared with the old distance was?

A. three times as much

B. the same

C. twice as much

D. half as much

**UTME, 2017**

**159.** If S = (4t + 3)(t − 2), find ds/dt when t = 5 secs.

A. 50 units per sec

B. 35 units per sec

C. 22 units per sec

D. 13 units per sec

**UTME, 2019**

**Integration**

**Integration Of Explicit Algebraic And Simple Trigonometrical Functions**

**160. Evaluate $\int \sin 2x\,dx$**

A. cos 2x + k

B. ½cos 2x + k

C. −½cos 2x + k

D. −cos 2x + k

**UTME, 2014**

**161. Find the minimum value of y = x² − 2x − 3**

A. 4

B. 1

C. −1

D. −4

**UTME, 2014**

**162.   Integral $\int(5x^3+7x^2-2x+5)dx$**

A. $5x^4/4 + 7x^3/3 - 5 + 2x + C$
B. $5x^4/4 + 7x^3/3 - x^2 + 5x + C$
C. $5x^3/3 + 7x^2/x - x + bC$
D. $2x^2/3 + x/5 - C$
**UTME, 2015**

**ANSWERS**

149. **SOLUTION**

y=xsinx

Which is the product of two functions, and so we apply the product rule for Differentiation:

d/dx(uv)=u$\frac{dv}{dx}$+v$\frac{du}{dx}$, or, (uv)'=(du)v+u(dv)

So with y=xsinx;

Let u=x    ⇒$\frac{du}{dx}$=1

v=sinx    ⇒$\frac{dv}{dx}$=cosx

Then:

$\frac{d}{dx}$(uv)=u$\frac{dv}{dx}$+v$\frac{du}{dx}$

Gives us:

$\frac{d}{dx}$(xsinx)=(x)(cosx)+(1)(sinx)

∴$\frac{dy}{dx}$=xcosx+sinx

**Option C is the correct answer**

150. **SOLUTION**

If y = 4x³ − 2x² + x, then;

δy/δx = 3(4x²) − 2(2x) + 1

= 12x² − 4x + 1

**The correct option is D**

151. **SOLUTION**

y = cos 3x

Let u = 3x so that y = cos u

Now, δy/δx=3,

δy/δx=−sinu

By the chain rule,

δy/δx=δy/δu×δu/δx

$\delta y/\delta x = (-\sin u)(3)$
$\delta y/\delta x = -3\sin u$
$\delta y/\delta x = -3\sin 3x$
**The Correct option is D**

**152. SOLUTION**

$2x^3 + 6x^2 + 6x + 1 = 3 \times 2x^{3-1} + 2 \times 6x^{2-1} + 1 \times 6x^{1-1}$
$= \delta y/\delta x = 6x^2 + 12x + 6$
**D is the correct option**

**153. SOLUTION**

$y = x\sin x$
$dy/dx = 1\sin x + x\cos x$
$= \sin x + x\cos x$
At $x = \pi/2$
$= \sin\pi/r + \pi/2\cos\pi/2$
$= 1 + \pi/2 \times 10$
$= 1$

**Option C is the correct answer**

**154. SOLUTION**

$$\frac{dy}{dx} = 3 \times 6x^{3-1} + (-2) \times 2x^{-2-1} - (-3)x^{-3-1} = 18x^2 - 4x^{-3} + 3x^{-4}$$
$$= 18x^2 - 4x^{-3} + 3x^{-4}$$
**Correct option is C**

**155.  SOLUTION**

$y = 2x^2(2x - 1)$

$y = 4x^3 - 2x^2$

$dy/dx = 12x^2 - 4x$

at $x = -1$

$dy/dx = 12(-1)22 - 4(-1)$

$= 12 + 4$

$= 16$

**B is the correct option**

**156.  SOLUTION**

$A = \pi r^2, \delta A/\delta r = 2\pi r$

So, using $\delta A/\delta t = \delta A/\delta r \times \delta A/\delta t$

$= 2\pi r \times 0.02$

$= 2\pi \times 7 \times 0.02$

$= 2 \times 22/7 \times 0.02$

$= 0.88 cm^2 s^{-1}$

**D is the correct option**

**157.  SOLUTION**

120km → 45litres

1km → 45/120litres

600km → 45/120 x 600 = 225litres

**The correct option is C**

### 158. SOLUTION

Let the speed of the 1st trip be x miles/hr

and the speed of the 2nd trip be 3x miles/hr

Speed = distance/time

∴ Time taken to cover a distance of 50 miles on the 1st trip

= 50/xhr

time taken to cover a distance of 300 miles on the next trip

= 300/3xhr

= 100/xhr

∴the new time compared with the old time is twice as much

**The correct option is C**

### 159. SOLUTION

$s = (4t+3)(t-2)$ s=(4t+3)(t-2)

$ds/dt = (4t+3)(1) + (t-2)(4)$

$ds/dt = (4t+3)(1) + (t-2)(4)$ = 4t+3+4t-84t+3+4t-8

= 8t - 5

$ds/dt(t=5secs) = 8(5)-5$

= $ds/dt(t=5secs) = 8(5)-5$

= 40 - 5

= 35 units per sec

**The correct option is B**

**160. SOLUTION**

Using integration by substitution together with the known integral $\int \sin(x)dx = -\cos(x)+C$, we first let u=2 then, du=2dx.

$\int \sin(2x)dx = 1/2\int \sin(2x)2dx$

$= 1/2\int \sin(u)du$
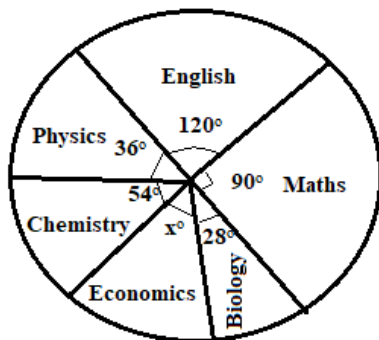
$= 1/2(-\cos(u))+K$

$= -1/2\cos(2x)+K$

**The correct option is C**

161. **SOLUTION**



$y = x^2 - 2x - 3$,

Then $\delta y/\delta x = 2x-2$

But at minimum point, $\delta y/\delta x = 0$,

Which means $2x - 2 = 0$

$2x = 2$

$x = 1$.

Hence the minimum value of $y = x^2 - 2x - 3$ is;

$y_{min} = (1)^2 - 2(1) - 3$

$y_{min} = 1 - 2 - 3$

$y_{min} = -4$

**The correct option is D**

**162.   SOLUTION**

By Integrating $(5x^3+7x^2-2x+5)dx$ we have;

$$= \frac{15x^{3+1}}{4} + \frac{7x^{2+1}}{3} + x^2 + 5x + C$$
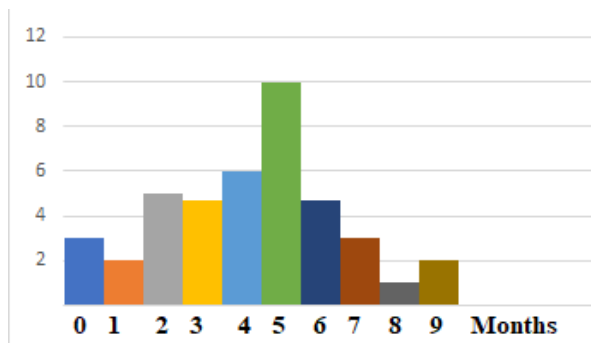
$$= \frac{15x^4}{4} + \frac{7x^3}{3} - x^2 + 5x + C$$

**The correct option is B**

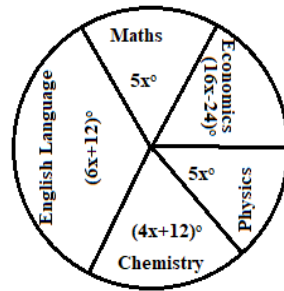# CHAPTER THIRTEEN

**STATISTICS**

**Representation of data**
**Histogram, Bar Chart And Pie Chart.**



**163.** The bar chart above shows the allotment of time (in minutes) per week for selected subjects in a certain school. What is the total time allocated to the six subjects per week?

A. 460mins
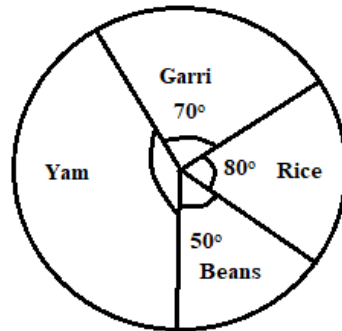B. 720mins
C. 960mins
D. 200mins
**UTME, 2013**

164.

**The pie chart above shows the statistical distribution of 80 students in five subjects in an examination. Calculate how many student offer Mathematics.**
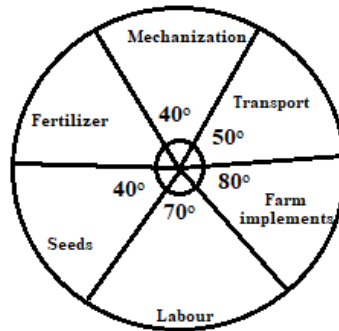
A. 30
B. 11
C. 50
D. 20
**UTME, 2013**

**165.** **The pie chart above shows the monthly distribution of a man's salary on food items. If he spent N8,000 on rice, how much did he spent on yam?**

A. N42,000
B. N18,000
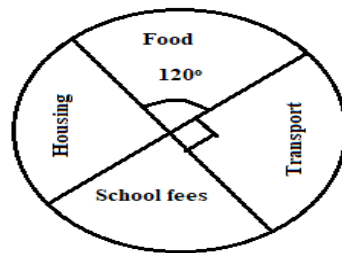C. N16,000
D. N12,000
**UTME, 2014**

166.

**The pie chart shows the allocation of money to each sector in a farm. The total amount allocated to the farm is ₦ 80 000. Find the amount allocated to fertilizer**

A. ₦ 35, 000
B. ₦ 40,000
C. ₦ 25,000
D. ₦ 20,000
**UTME, 2017**

**167.** The pie chart shows the monthly expenditure of a public servant. The monthly expenditure on housing is twice that of school fees. How much does the worker spend on housing if his monthly income is N7200?

A. 1000
B. 2000
C. 3000
D. 4000

**UTME, 2018**

**168.**

| Age in years | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|
| No of pupils | 4 | 13 | 30 | 44 | 9 |

**The table above shows the number of pupils in a class with respect to their ages. If a pie chart is constructed to represent the age, the angle corresponding to 8 years old is**

A. 48.6°

B. 56.3°

C. 46.8°

D. 13°

**UTME, 2019**

**169.   4, 16, 30, 20, 10, 14 and 26 are represented on a pie chart. Find the sum of the angles of the bisectors representing all numbers equals to or greater than 16**

A. 48°

B. 84°

C. 92°

D. 276°

**UTME, 2021**

**Measures of Location**

**Mean, Mode And Median Of Ungrouped And Grouped Data – (Simple Cases Only)**

**170.** The mean of seven numbers is 10. If six of the numbers are 2, 4, 8, 14, 16 and 18, find the mode.

A. 6
B. 8
C. 14
D. 2
**UTME, 2013**

**171.** Find the median of 5,9,1,10,3,8,9,2,4,5,5,5,7,3 and 6

A. 6
B. 5
C. 4
D. 3
**UTME, 2014**

**172.** If the mean of 4, y, 8 and 10 is 7. Find Y?

A. 6
B. 10
C. 7
D. 9
**UTME, 2016**

| Marks | 2 | 3 | 4 |
|---|---|---|---|
| Frequency | 4 | 4 | $y$ |

173.

**The table above shows the frequency distribution of marks obtained by a group of students. If the total mark is 48, find the value of y.**

A. 6
B. 8
C. 7
D. 5
**UTME, 2016**

| Scores | 3 | 6 | 5 | 2 |
|---|---|---|---|---|
| Frequency | 2 | 3 | 4 | 6 |

174.
   **From the table above, find the median**

A. 3
B. 5
C. 4
D. 6
**UTME, 2016**

**175.   The mean of 2-t, 4+t, 3-2t, 2+t and t-1 is**

A. 2
B. 2t
C. -t
D. -2
**UTME, 2016**

**176.   The mean of ten positive numbers is 16. When another number is added, the mean becomes 18. Find the eleventh number**

A. 3
B. 16
C. 38
D. 30
**UTME, 2021**

**Cumulative Frequency**

177.   OGIVE is constructed using

A. Third quartile range

B. Semi-quartile range

C. Cumulative frequency table

D. Inter-quartile table

UTME, 2016

**Measures of Dispersion**

**Range, Mean Deviation, Variance And Standard Deviation.**

178. If the variance of 3+x, 6, 4, x and 7-x is 4 and the mean is 5, find the standard deviation

A. $\sqrt{3}$
B. 2
C. 3
D. $\sqrt{2}$
**UTME, 2013**

179. Find the sum of the range and the mode of the set of numbers 10, 9, 10, 9, 8, 7, 7, 10, 8, 10, 8, 4, 6, 9, 10, 9, 7, 10, 6, 5

A. 16
B. 14
C. 12
D. 10
**UTME, 2017**

180.

| Score (x) | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|-----------|---|---|---|---|----|---|---|
| Freq (f)  | 5 | 7 | 3 | 7 | 11 | 6 | 7 |

Find the variance

A. 3.42
B. 4.69
C. 4.85
D. 3.72
**UTME, 2019**

**181.   Find the mean deviation of 1, 2, 3 and 4**

A. 1.0
B. 1.5
C. 2.0
D. 2.5
**UTME, 2021**

**Permutation and Combination**

**182.   In how many ways can a student select 2 subjects from 5 subjects?**

A. 5!/3!
B. 5!/2!2!
C. 5!/2!3!
D. 5!/2!
**UTME, 2013**

**183.   In how many ways can 3 seats be occupied if 5 people are willing to sit?**

A. 60
B. 20
C. 5
D. 120
**UTME, 2013**

**184.   In how many ways can the word MACICITA be arranged?**

A. 8!/2!
B. 8!/3!2!
C. 8!/2!2!2!
D. 8!

**UTME, 2017**

**185. LEADER be arranged?**

A. 72
B. 144
C. 360
D. 720

**UTME, 2018**

**186. In how many ways can the word MATHEMATICIAN be arranged?**

A. 6794800 ways
B. 2664910 ways
C. 6227020800 ways
D. 129729600 ways

**UTME, 2019**

**187. In how many ways can 2 students be selected from a group of 5 students in a debating competition?**

A. 25 ways
B. 10 ways
C. 15 ways
D. 20 ways

## ANSWERS

### 168. SOLUTION

Frequency of pupil of age 8 =13, Total frequency=4+13+30+44+9=100

Total sum of angles in a circle =360 degrees

So, angle representing pupils of age 8 $= \frac{13}{100} \times 360° = 46.8°$

**Correct option is C**

### 169. SOLUTION

Given that 4, 16, 30, 20, 10, 14 and 26

Adding up = 120

Numbers ≥ 16 are 16 + 30 + 20 + 26 = 92

The requires sum of angles = 92/120 x 360°/1

= 276°

**Therefore, correct option is D**

### 170. SOLUTION

**First find the value of the remaining number**

Mean $= \frac{2 +4+ 8+ 14+ 16 + 18+ x}{7}$ =10

$\frac{62+ x}{7}$ =10

$62 + x = 70$

X = 70 – 62 = 8

Therefore, all the seven numbers are 2, 4, 8, 8, 14, 16, 18

Mode = 8

**Correct option is B**

### 171. SOLUTION

First arrange the numbers in order of magnitude;

1,2,3,3,4,5,5,**5**,5,6,7,8,9,9,10

Hence the median = 5

**Correct option is B**

**172.SOLUTION**

$$\frac{4+y+8+10}{4} = 7$$

22 + y = 4 x 7

22 + y = 28

y = 28 – 22 = 6

**Correct option is A**


**173.   SOLUTION**

Total mark scored = 48

∴48 = $4\times 2 + 3 \times 4 + 4 \times y$

48 = 8+12+4y = 20 +4y

48–20 = 4y

28 = 4y

∴y = 7

**Correct option is C**


**174.   SOLUTION**

**2,2,2,2,3,3,3,3,4,4,4,4**

**Median = (3+3)/2**

**= 3**

**Correct option is A**


**175.   SOLUTION**

Σx = (t + 2) + (2t + 4) + (3t + 2) + 2t = 8t

N= 4

Mean x = $\frac{\Sigma x}{4} = \frac{8t}{4}$

= 2t

**Correct option is B**

### 176. SOLUTION

Mean of 10 numbers = 16
The total sum of numbers = 16 x 10 = 160
Mean of 11 numbers = 18
Total sum of numbers = 11 x 18
= 198
The 11th no. = 198 – 160
= 38
**Therefore, correct option is C**

### 177.SOLUTION

OGIVE is constructed using cumulative frequency table
**Correct option is C**

### 178. SOLUTION

Let $\delta 2$ and $\delta$ denote the variance and standard deviation of the distribution respectively.
But $\delta 2 = 4$ (given)
Hence $\delta = 4-\sqrt{4} = 2$
**Correct option is B**

### 179. SOLUTION

Range = Highest Number – Lowest Number
Mode is the number with highest occurrence
10, 9, 10, 9, 8, 7, 7, 10, 8, 4, 6,, 9, 10, 9, 7, 10, 6, 5
Range = 10 – 4 = 6
Mode = 10
Sum of range and mode = range + mode = 6 + 10
= 16
**Correct option is A**

**180.  SOLUTION**

**Explanation**

| x | f | fx | $(x - \bar{x})$ | $(x - \bar{x})^2$ | $f(x - \bar{x})^2$ |
|---|---|---|---|---|---|
| 0 | 5 | 0 | −3.26 | 10.628 | 53.14 |
| 1 | 7 | 7 | −2.26 | 5.108 | 35.756 |
| 2 | 3 | 6 | −1.26 | 1.588 | 4.764 |
| 3 | 7 | 21 | −0.26 | 0.068 | 0.476 |
| 4 | 11 | 44 | 0.74 | 0.548 | 6.028 |
| 5 | 6 | 30 | 1.74 | 3.028 | 18.168 |
| 6 | 7 | 42 | 2.74 | 7.508 | 52.556 |
| | 46 | 150 | | | 170.888 |

$$\text{Variance} = \frac{\sum f(x - \bar{x})}{\sum f} = \frac{170.888}{46}$$

= 3.72

**Correct option is D**

**181. SOLUTION**

Mean deviation = $\frac{\Sigma|x - \bar{x}|}{n}$

$\bar{x} = 2.5$

= |1 − 2.5| + |2 − 2.5| + |3 − 2.5| + |4 − 2.5|

= 4/4 = 1

**Correct option is A**

**182.  SOLUTION**

A student can select 2 subjects from 5 subjects in;

$^5C_3$ ways, i.e. $= 5!2!/(5-2)!$

$= 5!2!/3!$

**Correct option is C**

**183.  SOLUTION**

5 people can take 3 places in; $^5P_3$ ways, $= 5!/(5-3)!) = 5!/2!$

$= (5 \times 4 \times 3 \times 2!)/2!$

$= 5 \times 4 \times 3$

$= 60$ ways

**Correct option is A**

**184.  SOLUTION**

MACICITA is an eight letter word $= 8!$

Since we have repeating letters, we have to divide to remove duplicates accordingly. There are 2A, 2C, 2I

$$\frac{8!}{2!2!2!}$$

 **Correct option is C**

**185.  SOLUTION**

The word LEADER has 1L 2E 1A 1D and 1R making total of 6! $6!/(1!2!1!1!1!) = 6!/2!$

$= (6 \times 5 \times 4 \times 3 \times 2 \times 1)/(2 \times 1)$

$= 360$

**186.  SOLUTION**

MATHEMATICIAN has 13 letters with 2M, 3A, 2T, 2I.

Hence, the word MATHEMATICIAN can be arranged in

$$\frac{13!}{2!\,3!\,2!\,2!} = 129729600 \; ways$$

**Correct option is D**

187.   **SOLUTION**

In $_5C^2$ ways $= 5! \,/(5-2)!2!$

$= 5!/3!2!$

$= 5\times4\times3!/3!\times2\times1 = 10$ ways

**Correct option is B**

# CHAPTER FOURTEEN

**Probability**

**Experimental Probability (Tossing Of Coin, Throwing Of A Dice Etc)**

188.   The table shown gives the marks scored by a group of student in a test. Use the table to answer the question given.

| Mark | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Frequency | 1 | 2 | 7 | 5 | 4 | 3 |

What is the probability of selecting a student from the group that scored 2 or 3

A. 1/11
B. 5/22
C. 7/22
D. 6/11
**UTME, 2018**

189.   Tossing a coin and rolling a die are two separate events. What is the probability of obtaining a tail on the coin and an even number on the die?

A. 1/16
B. 1/6
C. 1/4
D. 3/8
**UTME, 2018**

**190.   If a fair coin is tossed 3 times, what is the probability of getting at least two heads?**

A. 2/3
B. 4/5
C. 2/5
D. 1/2
**UTME, 2019**

**191. Two fair dice are rolled. What is the probability that both show up the same number of point?**

A. 1/36
B. 7/36
C. 1/2
D. 1/6
**UTME, 2020**

**Addition And Multiplication Of Probabilities (Mutual And Independent Cases)**

**192.   A basket contains 9 apples, 8 bananas and 7 oranges. A fruit is picked from the basket, find the probability that it is neither an apple nor an orange.**

A. 3/8
B. 1/3
C. 7/24
D. 2/3
**UTME, 2013**

**193.** One bag contain 3 blue and 5 red balls, another bag contain 2 blue and 4 red balls respectively. One ball is drawn for each bag. What is the probability both balls are blue

A. 2/15
B. 3/24
C. 3/21
D. 3/28
**UTME, 2015**

**194.** The probability of an event A is 1/5. The probability of B is 1/3 . The probability both A and B is 1/15. What is the probability of either event A or B or both

A. 2/15
B. 3/4
C. 7/15
D. 1/15
**UTME, 2015**

**195.** If U = {x : x is an integer and 1 ≤ x ≤ 20 }

E1 = {x: x is a multiple of 3}

E2 = {x: x is a multiple of 4} and an integer is picked at random from U, find the probability that it is not in E2

A. ¾
B. 3/10
C. ¼
D. 1/20
**UTME, 2017**

**196.** The probabilities that John and James pass an examination are ¾ and 3/5 respectively. Find the probability of both boys failing the examination.

A. 1/10
B. 2/10
C. 9/20
D. 11/20
**UTME, 2018**

**197.** A bag contains 5 yellow balls, 6 green balls and 9 black balls. A ball is drawn from the bag. What is the probability that it is black or yellow ball

A. 37/160
B. 133/400
C. 7/10
D. 133/800
**UTME, 2020**

**198.** Find the probability that a number selected at random from 41 to 56 is a multiple of 9

A. 1/8
B. 2/15
C. 3/16
D. 7/8
**UTME, 2021**

# ANSWERS

### 188. SOLUTION

Total mark frequency = 22

Therefore prob. Of having a 2 or 3 =

$\frac{2}{22} + \frac{3}{22} = \frac{5}{22}$

**Correct option is B**

### 189. SOLUTION

Probability $\left(\text{tail on a coin}\right) = \frac{1}{2}$

Even numbers on a coin are 2, 4 and 6 so

Probability (even number on a die) = 3/6 = 1/2

Probability $\left(\text{tail on a coin and even number on a die}\right) = \frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$

**Correct option is C**

### 190. SOLUTION

When a fair coin is tossed 3 times we have these 8 possibilities below

$\{$HHH,HHT,HTH,HTT,THT,TTT,TTH,THH$\}$

And getting at least two head means getting 2 heads or more

So we have $\{$HHH,HHT,HTH,THH$\}$ 4 possibilities

So P$\left(\text{at least two heads}\right)$ = 4/8 =1/2

**Correct option is D**

### 191. SOLUTION

Two fair dice rolled = 36

Prob of having the same number of point appear= 6/36

=1/6

**Correct option is D**

### 192. SOLUTION
n(apples) = 9
n(bananas) = 8
n(oranges) = 7
n($\varepsilon$) = 24
Hence Prob(not apple, nor orange) = Prob(banana) = 8/24 = 1/3
**Correct option is B**

### 193. SOLUTION
One bag with 3 blue and 5 red
Pr (H) = 3/8Pr (r) 5/8
Another bag with 2 blue and 4 red (note one ball is drawn from each bag)
i.e. prob.=8 - 1 = 7
prob. (2 ball both are blue=pr (1st blue and 2nd blue)
prob. 2 balls both blue = 3/8 × 2/7
= 3/28
**Correct option is D**

### 194. SOLUTION
Prob of Event A= 1/5
Prob of Event B =1/3
Prob of both = 1/15
**Prob of either A or B or Both = P (A) + P (B) – P (AB)**

**=1/5 +1/3 − 1/15**
**Correct option is C**

**195.   SOLUTION**

$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$
$E_1 = \{3, 6, 9, 12, 15, 18\}$
$E_2 = \{4, 8, 12, 16, 20\}$
Probability of $E_2$ = 5/20 i.e Total number in $E2$/Entire number in set
Probability of set $E_2$ = 1 − 5/20
= 15/20
= ¾
**Correct option is A**

**196.   SOLUTION**

Pr(both John and James passed)
  = 3/4 x 3/5
  = 9/20
  Pr(john and james failed) = 1- Pr(john and james passed)
  = 1 − 9/20
  = 11/20
**Correct option is D**

**197.   SOLUTION**

Total balls is 20
5 Yellow
6 Green
9 Black
Probability of yellow is 5/20
Probability of black is 9/20
Add both 5/20 + 9/20
= (5 + 9)/20

= 14/20

= 7/10

**Correct option is E**

**198.  SOLUTION**

Given from 41 to 56

41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56

The nos multiple of 9 are: 45, 54

P(multiple of 9) = 2/16

= 1/8

**Therefore, correct option is A**