Acing UTME Maths

A Comprehensive Guide with Past Questions and Solutions

By

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Dedication and Acknowledgements

This work is dedicated to our families, whose unwavering support has been our greatest strength throughout this journey. Their constant encouragement and belief in our abilities have fueled our passion and perseverance in creating this resource.

We would also like to express our sincere gratitude to the following individuals and institutions for their invaluable contributions:

- Our mentors and teachers, who instilled in us a love for mathematics and equipped us with the knowledge and skills needed to succeed.
- The examiners and administrators of the UTME, whose dedication to educational standards ensures a fair and effective assessment process.
- Our colleagues and friends, who provided feedback and support throughout the development of this book.
- The wider academic community, whose research and publications have laid the foundation for our understanding of mathematics.

We are truly grateful for the collective effort that has made this book possible. We hope that it will be a valuable resource for students preparing for the UTME and beyond.

A Note on Preparation

This book was meticulously prepared using the LaTeX document processing system, a powerful tool for typesetting high-quality scientific and mathematical texts. The diagrams herein were crafted using the TikZ package. We extend our thanks to the developers of the LaTeX system and the numerous packages that made this work possible.

About the Authors

Ayodeji Adesegun: He is a teenager. In his spare time, he enjoys solving mathematical problems from various contests not excluding the Olympiads. You can find more about him here.

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Preface

Welcome to “Acing UTME Maths”, a comprehensive guide designed to help you conquer the upcoming UTME Maths exam. This book provides you with a wealth of past questions, detailed solutions, and insightful strategies to enhance your understanding and preparation.

This book is organized into chapters that follow the official UTME Maths syllabus, covering all key topics and subtopics. Each chapter includes a variety of past questions carefully selected to reflect the types and difficulty levels encountered in the actual exam.

In addition to past questions, we have provided detailed solutions that explain the reasoning behind each step and highlight common mistakes to avoid. We encourage you to work through these solutions carefully and utilize them as learning tools to improve your problem-solving skills.

Furthermore, we have incorporated valuable strategies throughout the book, offering tips and techniques to maximize your efficiency and performance on the exam. These strategies will help you manage your time effectively, approach different question types confidently, and overcome any challenges you may encounter.

We are confident that “Acing UTME Maths” will be your ultimate companion on your journey to success. By diligently working through the material and utilizing the resources provided, you will gain the knowledge, skills, and confidence needed to achieve your desired score on the UTME Mathematics exam.

Best of luck!

Ayodeji Adesegun and Chimobi Nwafor

Chapter 1

Number and Numeration

1.1 Number Bases

1.1.1 Questions

1. The number 25 when converted from the tens and units base to the binary base (base 2) is:

   A. 10011

   B. 1111011

   C. 111000

   D. 11001

   E. 110011

2. A woman bought 4 bags of rice at $N56$ per bag and 3 tins of milk at $N4$ per tin. What is the total cost of the items she bought?

   A. $N245$

   B. $N242$

   C. $N236$

   D. $N341$

   E. $N338$

3. Evaluate $212_3 - 121_3 + 222_3$.

   A. 313_3

   B. 1000_3

   C. 1020_3

   D. 1222_3

   E. 1213_3

4. A trader in a country where the currency 'MONT' (M) is in base five bought 103_5 oranges at $M14_5$ each. If he sold the oranges at $M24_5$ each, what would be his gain?

   A. $M103_5$

   B. $M1030_5$

   C. $M102_5$

   D. $M2002_5$

   E. $M3024_5$

5. Find x if $(x_4)^2 = (100100)_2$.

   A. 6

   B. 12

   C. 100

   D. 210

   E. 10042

6. Convert 241_5 to base 8.

   A. 71_8

   B. 107_8

   C. 176_8

   D. 241_8

7. In the equation $\frac{11_2}{x_2} = \frac{1000_2}{x_2 + 101_2}$, solve for x.

   A. 101

   B. 11

   C. 110

   D. 111

   E. 10

8. $4243_5 - 12x4_5 = y344_5$. What is the difference between x and y?

   A. 4

   B. 2

   C. 1

D. 3

E. 5

9. In base ten, the number 101101_2 equals:

A. 15

B. 45

C. 23

D. 12

10. Convert the number 39 to base 2.

A. 100111

B. 111001

C. 110111

D. 111111

E. 100101

11. Find n if $34_n = 10110_2$.

A. 5

B. 6

C. 7

D. 8

E. 9

12. If $2_9 \times (Y3)_9 = 3_5 \times (Y3)_5$, find the value of Y.

A. 4

B. 3

C. 2

D. 1

E. 5

13. Simplify $213_4 \times 23_4$.

A. 10321_4

B. 12231_4

C. 13221_4

D. 10311_4

E. 13021_4

14. $55_x + 52_x = 77_{10}$, find x.

A. 5

B. 6

C. 7

D. 8

E. 10

15. If $x_{10} = 23_5$, find x.

A. 15

B. 12

C. 14

D. 13

E. 16

16. Find the sum of 25_6, 52_6, 43_6 in base 8.

A. 411

B. 141

C. 114

D. 417

17. If $2A3_3 = 77_8$, find A.

A. 1

B. 2

C. 0

D. 4

18. Evaluate $(202_3)^2 - (112_3)^2$.

A. 21112

B. 21121

C. 21011

D. 21120

19. If 321_4 is divided by 23_4 and leaves a remainder r, what is the value of r?

A. 4

B. 2

C. 3

D. 0

E. 1

20. Convert 521_{10} to a number in base 5.

A. 1404_5

B. 4041_5

C. 4140_5

D. 4014_5

E. 4104_5

21. If $6R7_8 = 511_9$, find R.

A. 6

B. 5

C. 3

D. 2

E. 8

22. Find the value of x if $121_x + 112_x = 30_{10}$.

    A. 5
    B. 7
    C. $-\frac{9}{2}$
    D. 3
    E. 4

23. Evaluate $(1011_2)^2$ - 1012_2.

    A. 110000_2
    B. 110000_2
    C. 101011_2
    D. 110110_2

24. Add 1101_2, 11011_2 and 111_2.

    A. 110110_2
    B. 101011_2
    C. 111011_2
    D. 101010_2
    E. 110011_2

25. Find the value of m if $13_m + 24_m = 41_m$.

    A. 8
    B. 5
    C. 4
    D. 6
    E. 3

26. If $125_x = 20_{10}$, find x.

    A. 2
    B. 3
    C. 4
    D. 6
    E. 5

27. If $(K2)_6 \times 3_6 = 3_5(K4)_5$, what is the value of k?

    A. 2
    B. 1
    C. 3
    D. 4
    E. 5

28. Find P, if $451_6 - P_7 = 305_6$.

    A. 116_7
    B. 62_7
    C. 611_7
    D. 142_7

29. The sum of four numbers is 1214_5. What is the average expressed in base 5?

    A. 141
    B. 411
    C. 417
    D. 114
    E. 471

30. If $(1P03)_4 = 115_{10}$, find P.

    A. 2
    B. 0
    C. 1
    D. 4
    E. 3

31. If $(P344)_6 - (23P2)_6 = (2PP2)_6$, find the digit P.

    A. 1
    B. 2
    C. 3
    D. 4
    E. 5

32. $4243_5 - (12X4)_5 = Y344$. What is the difference between X and Y?

    A. 1
    B. 2
    C. 3
    D. 4
    E. 5

33. Convert 67_{10} to base 2.

    A. 1000011_2
    B. 1000101_2
    C. 1100011_2
    D. 1010011_2

34. Evaluate $1101_2 + 1011_2$.

    A. 11000_2
    B. 10110_2
    C. 11010_2
    D. 11100_2

35. If $432_x = 156_{10}$, find x.

A. 5
B. 6
C. 7
D. 8

36. Convert 1234_5 to base 10.

A. 194
B. 189
C. 204
D. 214

37. Simplify $321_4 + 132_4$.

A. 1123_4
B. 1213_4
C. 1203_4
D. 1130_4

38. If $101_x + 11_x = 1000_x$, find x.

A. 2
B. 3
C. 4
D. 5

39. Evaluate $10110_2 - 1101_2$.

A. 1001_2
B. 1011_2
C. 111_2
D. 1111_2

40. Convert 255_{10} to base 16.

A. FF_{16}
B. FE_{16}
C. EF_{16}
D. $F0_{16}$

41. If $212_3 \times 2_3 = x_3$, find x.

A. 1201_3
B. 1101_3
C. 2021_3
D. 1011_3

42. Find n if $144_n = 100_{10}$.

A. 6
B. 7
C. 8
D. 9

43. Convert 345_6 to base 8.

A. 215_8
B. 225_8
C. 205_8
D. 235_8

44. Evaluate $111_2 \times 101_2$.

A. 100011_2
B. 110011_2
C. 100111_2
D. 101011_2

45. If $54_x = 34_{10}$, find x.

A. 5
B. 6
C. 7
D. 8

46. Simplify $2134_5 + 3421_5$.

A. 11110_5
B. 11010_5
C. 10110_5
D. 11210_5

47. Convert 1000000_2 to base 10.

A. 64
B. 128
C. 32
D. 256

48. If $ABC_{16} = x_{10}$, where $A = 10, B = 11, C = 12$, find x.

A. 2748
B. 2847
C. 2784
D. 2874

49. Evaluate $1010_2 \div 10_2$.

A. 101_2
B. 110_2
C. 100_2
D. 111_2

50. If $234_x + 123_x = 412_x$, find x.

A. 5
B. 6
C. 7
D. 8

51. Convert 72_{10} to base 8.

A. 110_8
B. 100_8
C. 111_8
D. 120_8

52. Simplify $444_5 - 232_5$.

A. 212_5
B. 202_5
C. 222_5
D. 112_5

53. If $1011_2 \times x_2 = 101101_2$, find x.

A. 11_2
B. 101_2
C. 111_2
D. 1001_2

54. Convert 1010101_2 to base 10.

A. 85
B. 95
C. 75
D. 65

55. Evaluate $432_5 \times 3_5$.

A. 2341_5
B. 2441_5
C. 2141_5
D. 2041_5

56. If $3x4_5 = 59_{10}$, find x.

A. 1
B. 2
C. 3
D. 4

57. Convert 156_{10} to base 7.

A. 312_7
B. 315_7
C. 321_7
D. 314_7

58. Simplify $11011_2 + 10111_2 + 1101_2$.

A. 110001_2
B. 111001_2
C. 101001_2
D. 110101_2

59. If $x_4 \times 23_4 = 132_4$, find x.

A. 2_4
B. 3_4
C. 10_4
D. 11_4

60. Evaluate $10000_2 - 1111_2$.

A. 1_2
B. 10_2
C. 11_2
D. 1_2

61. Convert $1A3_{16}$ to base 10.

A. 419
B. 429
C. 439
D. 449

62. If $201_x - 102_x = 22_x$, find x.

A. 3
B. 4
C. 5
D. 6

63. Simplify $2103_4 + 3012_4$.

A. 11121_4
B. 12111_4
C. 11211_4
D. 10321_4

64. Convert 500_{10} to base 9.

A. 615_9
B. 605_9
C. 625_9
D. 616_9

65. If $110_2 \times 11_2 \times 10_2 = x_2$, find x.

A. 100100_2

B. 101100_2

C. 110100_2

D. 111100_2

66. Evaluate $543_6 - 254_6$.

A. 245_6

B. 255_6

C. 235_6

D. 225_6

67. If $1x2_3 + 201_3 = 1010_3$, find x.

A. 0

B. 1

C. 2

D. 3

68. Convert 1111111_2 to base 10.

A. 127

B. 128

C. 255

D. 256

69. Simplify $3421_5 \times 2_5$.

A. 13342_5

B. 14342_5

C. 12342_5

D. 13442_5

70. If $x_8 + 37_8 = 100_8$, find x.

A. 40_8

B. 41_8

C. 50_8

D. 51_8

71. Convert 200_{10} to base 6.

A. 532_6

B. 542_6

C. 552_6

D. 512_6

72. Evaluate $111_2 + 111_2 + 111_2$.

A. 10101_2

B. 10011_2

C. 11001_2

D. 10111_2

73. If $43_x \times 2_x = 136_x$, find x.

A. 5

B. 6

C. 7

D. 8

74. Convert $3E7_{16}$ to base 10.

A. 997

B. 999

C. 987

D. 1007

75. Simplify $1234_5 - 432_5$.

A. 302_5

B. 402_5

C. 312_5

D. 412_5

76. If $1101_2 \div x_2 = 11_2$, find x.

A. 10_2

B. 11_2

C. 100_2

D. 101_2

77. Evaluate $321_4 \times 12_4$.

A. 10302_4

B. 11302_4

C. 10202_4

D. 11202_4

78. Convert 1000_{10} to base 12.

A. $6B4_{12}$

B. $6A4_{12}$

C. 694_{12}

D. 684_{12}

79. If $x2x_3 = 50_{10}$, find x.

A. 1

B. 2

C. 0

D. 3

80. Simplify $10111_2 - 1010_2 - 101_2$.

A. 1000_2

B. 1100_2

C. 1010_2

D. 1110_2

81. Convert 777_8 to base 10.

A. 511

B. 521

C. 501

D. 531

82. If $1x0_4 + 201_4 = 1011_4$, find x.

A. 0

B. 1

C. 2

D. 3

83. Evaluate $432_5 + 143_5 + 321_5$.

A. 1401_5

B. 1341_5

C. 1441_5

D. 1301_5

84. Convert 11001100_2 to base 16.

A. CC_{16}

B. CD_{16}

C. DC_{16}

D. DD_{16}

85. If $210_x \times 2_x = 1120_x$, find x.

A. 3

B. 4

C. 5

D. 6

86. Simplify $654_7 - 365_7$.

A. 256_7

B. 266_7

C. 356_7

D. 246_7

87. Convert 128_{10} to base 4.

A. 2000_4

B. 1000_4

C. 10000_4

D. 3000_4

88. If $11x_4 = 23_{10}$, find x.

A. 1

B. 2

C. 3

D. 0

89. Evaluate $1111_2 \times 1111_2$.

A. 11100001_2

B. 11010001_2

C. 11001001_2

D. 11110001_2

90. Convert 343_5 to base 10.

A. 98

B. 88

C. 108

D. 93

91. If $x4_6 + 25_6 = 103_6$, find x.

A. 3

B. 4

C. 5

D. 2

92. Simplify $10101_2 + 11_2$.

A. 11000_2

B. 10111_2

C. 11001_2

D. 11010_2

93. Convert 99_{10} to base 3.

A. 10200_3

B. 10020_3

C. 10100_3

D. 11000_3

94. If $231_x - 112_x = 114_x$, find x.

A. 5

B. 6

C. 7

D. 8

95. Evaluate $2413_5 + 1324_5$.

A. 4242_5

B. 4342_5

C. 4142_5

D. 4442_5

96. Convert 1024_{10} to base 2.

A. 10000000000_2

B. 100000000_2

C. 1000000000_2

D. 10000000_2

97. The equation $100_x \div 10_x = 10_x$ is true for all values of x except:

A. $x = 1$

B. $x = 2$

C. $x = 0$

D. Never true

98. Simplify $333_4 + 222_4 + 111_4$.

A. 1222_4

B. 1332_4

C. 1232_4

D. 2222_4

99. Convert $B4_{16}$ to base 2.

A. 10110100_2

B. 10101100_2

C. 11010100_2

D. 10110010_2

100. Solve for x in the equation $23_x = 15_{10}$.

A. 5

B. 6

C. 7

D. 8

1.2 Fraction and Decimals

1.2.1 Questions

1. The sum of $3\frac{7}{8}$ and $1\frac{1}{3}$ is greater than the difference between $\frac{3}{8}$ and $1\frac{2}{3}$ by?

A. $3\frac{2}{3}$ C. $8\frac{1}{8}$ E. $5\frac{1}{4}$

B. $1\frac{1}{2}$ D. $3\frac{11}{12}$

2. After getting a rise of 15%, a man's new monthly salary is N 345. How much per month did he earn before the increase?

A. N360 C. N293.25 E. N396.75

B. N300 D. N330

3. Find correct to 3 significant figures, the value of $\sqrt{41830}$

A. 647 C. 205 E. 6470

B. 2050 D. 647

4. 12 men complete a job in 9 days. How many men working at the same rate, would be required to complete the job in 6 days?

A. 24 C. 8 E. 18

B. 9 D. 12

5. Simplify $2\frac{5}{12} - 1\frac{7}{8} \times \frac{6}{5}$.

A. $\frac{11}{30}$ C. $\frac{1}{6}$ E. $\frac{13}{20}$

B. $\frac{9}{4}$ D. $\frac{5}{3}$

6. By selling an article for N45.00 a man makes a profit of 8%. For how much should he have sold it in order to make a profit of 32%?

A. N59.00 C. N180.00 E. N42.00

B. N55.00 D. N63.00

7. Which of the following fractions is less than one-third?

A. $\frac{4}{11}$ C. $\frac{15}{44}$ E. $\frac{6}{14}$

B. $\frac{122}{383}$ D. $\frac{22}{63}$

8. The ratio of the price of loaf of bread to the price of a packet of sugar in 1975 was $a : x$. In 1980, the price of a loaf of bread went up by 25% and that of a packet of sugar by 10%. Their new ratio is now ?

A. $50a : 44x$ C. $40a : 44x$ E. $44a : 55x$

B. $44a : 50x$ D. $55a : 44x$

9. Simplify: $1 + \cfrac{2}{3 + \cfrac{4}{5 + \cfrac{6}{7}}}$

   A. $\frac{7}{95}$
   B. $\frac{177}{95}$
   C. $\frac{233}{151}$
   D. $\frac{17}{10}$
   E. $\frac{3}{10}$

10. Evaluate and correct to 4 decimal places 827.51×0.015 .

    A. 124.1265
    B. 8.8415
    C. 12.4127
    D. 12.4120
    E. 124.1265

11. A micrometer is defined as one millionth of a millimeter. A length of 12, 000 micrometer may be represented as

    A. $0.000012m$
    B. $0.12m$
    C. $0.00000012m$
    D. $0.00000000012m$
    E. $0.0000012m$

12. The difference between $4\frac{5}{7}$ and $2\frac{1}{4}$ is greater than the sum of $\frac{1}{14}$ and $1\frac{1}{2}$ by?

    A. $\frac{27}{28}$
    B. $\frac{23}{28}$
    C. $\frac{50}{56}$
    D. $\frac{48}{56}$
    E. $\frac{24}{48}$

13. When a dealer sells a bicycle for N81, he makes a profit of 8%. What did he pay for the bicycle.

    A. N75
    B. N75.52
    C. N74.52
    D. N87.48
    E. N73

14. A man and wife went to by an article costing N400. The woman had 10% of the cost and the man 40% of the remainder. How much did they have altogether?

    A. N186
    B. N184
    C. N200
    D. N144
    E. N100

15. A sum of money invested at 5% per annum simple interest amount to N285.20 after 3 years. How long will it take the same sum to amount to N434.00 at $7\frac{1}{2}$% per annum simple interest?

    A. 10 years
    B. 12 years
    C. $7\frac{1}{2}$ years
    D. 14 years
    E. 5 years

16. A construction company is owned by two partners A and B and it is agreed that their profit will be divided in ratio $4 : 5$, at the end of the year, B received N5, 000 more than A. What is the total profit of the company for the year?

    A. N45, 000
    B. N30, 000
    C. N150, 000
    D. N25, 000
    E. N30, 000

17. The diameter of metal rod is measured as 23.40cm to 4 significant figures. What is the maximum error in the measurement?

    A. 0.0004cm
    B. 0.05cm
    C. 0.005cm
    D. 0.5cm
    E. 0.45cm

18. Simplify: $3 - \cfrac{2}{\frac{4}{5} + \frac{1}{2}}$

A. $1\frac{9}{10}$

B. $1\frac{3}{10}$

C. $1\frac{3}{4}$

D. -1

E. 1

19. Given that $x : y = \frac{1}{3} : \frac{1}{2}$ and $\psi : \theta = \frac{2}{5} : \frac{4}{7}$, find $x : \theta$.

A. 20 : 21

B. 7 : 15

C. 3 : 20

D. 2 : 35

E. 4 : 105

20. If N560 is shared in the ratio 7 : 2 : 1, what is the smallest share?

A. N392

B. N113.40

C. N56.00

D. N87.48

E. N126.41

21. Simplify: $\frac{1}{2} + \cfrac{1}{2 + \cfrac{1}{2 - \cfrac{1}{4 + \frac{1}{5}}}}$

A. $\frac{169}{190}$

B. $-\frac{1}{3}$

C. $\frac{13}{15}$

D. $-\frac{3}{4}$

E. $-\frac{14}{27}$

22. $22\frac{1}{2}\%$ of the Nigerian Naira equals $17\frac{1}{10}\%$ of a foreign currency M. What is the conversion rate of M to Naira?

A. $2\frac{11}{57}$ Naria

B. $1\frac{18}{57}$ Naria

C. $\frac{15}{59}$ Naria

D. $\frac{15}{57}$ Naria

E. $38\frac{1}{4}$ Naria

23. Divide the LCM of 48, 64, and 80 by their HCF.

A. 30

B. 48

C. 52

D. 20

E. 60

24. A sum of money was invested at 8% per annum simple interest. If after 4 years the money amounts to N330.00, find the amount originally invested.

A. N150

B. N200

C. N165

D. N180

E. N250

25. P sold his bicycle to Q at a profit of 10%. Q sold to R for N209 at a loss of 5%. How much did the bicycle cost P?

A. N150

B. N205

C. N180

D. N196

E. N200

26. Find the smallest number by which 252 can be multiplied to obtain a perfect square.

A. 2

B. 3

C. 5

D. 7

E. 9

27. Find the reciprocal of: $\dfrac{\frac{2}{3}}{\frac{1}{2} + \frac{1}{3}}$

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

B. $\frac{2}{5}$

C. $\frac{6}{9}$

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

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

28. Three boys shared some oranges, the first recieved $\frac{1}{3}$ of the oranges, the second received $\frac{2}{3}$ of the remainder, if the third boy recieved the remaining 12 oranges. How many oranges did they share?

A. 48

B. 72

C. 54

D. 42

E. 60

29. Udoh deposited N150.00 in the bank. At the end of 5 years, the simple interest on the principal was N55.00. At what rate per annum was the interest paid

A. $7\frac{1}{3}\%$

B. 5%

C. 11%

D. $3\frac{1}{2}\%$

E. $4\frac{2}{5}\%$

30. A number of pencil were shared among Desmond, Florence, and Kevin in ratio 2 : 3 : 5 respectively. If Desmond got 5, how many were shared out?

A. 30

B. 15

C. 25

D. 20

E. 35

31. Find the least length of a rod which can be cut into exactly equal strips, each of 40 cm or 48 cm in length.

A. 240 cm

B. 480 cm

C. 360 cm

D. 120 cm

E. 480 cm

32. A rectangular lawn has an area of 1815 square yards. If its length is 50 metres, find its width in meters. Given that 1 metre equals 1.1 yard.

A. 30.00 m

B. 33.00 m

C. 32.00 m

D. 39.93 m

E. 36.45 m

33. Reduce each number to two significant figures and then evaluate $\frac{0.021741 \times 1.2047}{0.023789}$

A. 0.8

B. 1.2

C. 1.1

D. 0.9

E. 0.6

34. A cinema hall contains a certain number of people. If $27\frac{1}{2}\%$ are children, $47\frac{1}{2}\%$ are men and 84 are women, find the number of men in the hall

A. 133

B. 84

C. 63

D. 113

35. A woman buys 270 oranges for N1, 800 and sells at 5 for N40. What is her profit?

A. N 1, 620

B. N 630

C. N 360

D. N 2, 160

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

A. 720 litres

B. 225 litres

C. 960 litres

D. 160 litres

37. Simplify $1 - \left(\frac{1}{7} \times 3\frac{1}{2}\right) \div \frac{3}{4}$

A. 2

B. 1

C. $\frac{1}{3}$

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

38. Evaluate: $\frac{12.02 \times 20.06}{26.04 \times 60.06}$, correct to 3 significant figures

A. 0.154

B. 0.155

C. 0.158

D. 0.157

39. Evaluate: $\frac{0.8 \times 0.43 \times 0.031}{0.05 \times 0.72 \times 0.021}$, correct to 3 significant figures

A. 14.1

B. 14.09

C. 14.12

D. 14.11

40. A man bought a car for N500, 000 and was able to sell it for N350, 000, what was his percentage loss?

A. 50%

B. 30%

C. 70%

D. 60%

41. Simplify: $1\frac{2}{3} + 4\frac{1}{4} + 1\frac{5}{12}$

A. $4\frac{1}{3}$

B. $4\frac{2}{3}$

C. $4\frac{12}{17}$

D. $4\frac{3}{17}$

42. A man donates 16% of his monthly net earning to the church. If it amounts to N4, 500, what is his monthly income?

A. N40, 500

B. N52, 000

C. N52, 500

D. N45, 000

43. If a student measured the length of a table to be 2.30 m insted of 2.50 m. What was his percentage error in measuring the length?

A. 7%

B. 10%

C. 9%

D. 8%

44. A man bought a second-hand photocopy machine for 34, 000. He serviced it at a cost of N2, 000 and then sold it at a profit of 15%. What was the selling price?

A. 37, 550

B. 40, 000

C. 41, 400

D. 42, 400

45. A student spent $\frac{1}{5}$ of his allowance on books, $\frac{1}{3}$ of the remainder on food and kept the rest for contingencies. What fraction was kept?

A. $\frac{8}{15}$

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

C. $\frac{2}{3}$

D. $\frac{7}{15}$

46. If $p : q = \frac{2}{3} : \frac{5}{6}$ and $\frac{3}{4} : \frac{1}{2}$, find $p : q : r$

A. 12 : 15 : 10

B. 10 : 15 : 24

C. 9 : 10 : 15

D. 12 : 15 : 16

47. Simplify: $\frac{3\frac{2}{3} \times \frac{5}{6} \times \frac{2}{3}}{\frac{11}{25} \times \frac{3}{4} \times \frac{2}{27}}$

A. $4\frac{1}{3}$

B. 30

C. $5\frac{2}{3}$

D. 50

48. A man earns N3, 500 per month out of which he spend 15% on his children's education. If he spends additional N1, 950 on food, how much does he have left?

A. N2, 975

B. N1, 950

C. N525

D. N1025

49. Evaluate $\frac{21}{9}$ to 3 significant figures

A. 2.30

B. 2.31

C. 2.32

D. 2.33

50. A girl shares a number of apples in the ratio 5 : 3 : 2. If the highest share is 40, find the smallest share.

A. 74

B. 38

C. 36

D. 16

51. Calculate the time taken for N3, 000 to earn N600 at 8% simple interest.

A. 3 years

B. $2\frac{1}{2}$ years

C. $1\frac{1}{2}$ years

D. $3\frac{1}{2}$ years

52. Find the tax on an income of N20, 000 if no tax is paid on the first N10, 000 and tax is paid at N50 and in N1, 000 on the next N5, 000 and at N55 and N1000 on the remainder.

A. N225

B. N525

C. N552

D. N500

53. The time taken to do a piece of work is inversely proportional to the number of men employed. If it takes 30 men to do a piece of work in 6days, how many men are required to do the work in 4 days?

A. 35

B. 45

C. 25

D. 60

54. Three boys shared oranges. The first received $\frac{1}{3}$ of the oranges and the second received $\frac{2}{3}$ of the remainder. If the third boy received the remaining 12 oranges, how much oranges did they share?

A. 42

B. 60

C. 54

D. 48

55. A farmer planted 5, 000 grains of maize and harvested 5, 000 cobs, each bearing 500 grains. What is the ratio of the number of grains sowed to the number harvested?

A. 1 : 5, 000

B. 1 : 25, 000

C. 1 : 500

D. 1 : 250, 000

56. Evaluate: $\frac{0.21 \times 0.072 \times 0.00054}{0.006 \times 1.68 \times 0.063}$

A. 0.1286

B. 0.01285

C. 0.01286

D. 0.1285

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

A. 828

B. 756

C. 720

D. 684

58. Find correct to 3 decimal places:

$$\left(\frac{1}{0.05}\right) \div \left(\frac{1}{5.005}\right) - (0.05 \times 2.05)$$

A. 99.998

B. 9.998

C. 98.999

D. 89.899

59. Express $62 \div 3$ as a decimal correct to 3 significant figures.

A. 20.667

B. 20.6

C. 20.7

D. 20.67

60. Factory P produces 20,000 bags of cement per day while factory Q produces 15,000 bags per day. If P reduces production by 5% and Q increases production by 5% determine the effective loss in the number of bags produced per day by the two factories

A. 750

B. 250

C. 1000

D. 1250

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

A. $2\frac{4}{5}$

B. $18\frac{7}{8}$

C. $18\frac{1}{8}$

D. $16\frac{7}{8}$

62. The radius of a circle is given as 5cm subject to an error of 0.1cm. What is the percentage error in the area of the circle?

A. $\frac{1}{4}$

B. $\frac{1}{25}$

C. 25

D. 4

63. A man invested a sum of N280.00 partly at 5% and partly at 4%. If the total interest is N12.8 per annum, find the amount invested at 5%.

A. N120

B. N160

C. N200

D. N140

64. Evaluate $\frac{3524}{0.05}$ correct to 3 significant figures

A. 70000

B. 70480

C. 705

D. 70500

65. If N225 yields N27 in x years simple interest at the rate of 4% per annum, find x

A. 12

B. 4

C. 27

D. 3

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

A. N756

B. N648

C. N720

D. N828

67. $\frac{1}{3} \div \left[\frac{5}{7}\left(\frac{9}{10} - 1 + \frac{3}{4}\right)\right]$

A. $\frac{13}{24}$

B. $\frac{39}{28}$

C. $\frac{28}{39}$

D. $\frac{84}{13}$

68. Two sisters, Taiwo and Kehinde, own a store. The ratio of Taiwo's share to Kehinde's is 11 : 9. Later Kehinde sells $\frac{2}{3}$ of her share to Taiwo for N720. Find the value of the store.

A. 1080

B. 3000

C. 3600

D. 2400

69. A tax payer has allowed $\frac{1}{8}$th of his income tax free, and pays 20% on the remainder. If he pays N490 tax, what is his income?

A. N2450

B. N2800

C. N3920

D. N560

70. A basket contains green, black and blue balls in the ratio 5 : 2 : 1. If there are 10 blue balls, find the corresponding new ratio when 10 green and 10 black balls are removed from the basket

A. 1 : 1 : 1

B. 4 : 2 : 1

C. 5 : 1 : 1

D. 4 : 1 : 1

71. The prime factors of $2,520$ are:

A. $2, 3, 5, 7$

B. $2, 9, 5$

C. $2, 3, 7, 9$

D. $2, 9, 7$

72. Simplify: $\frac{2}{3} + \frac{3}{4} - \frac{5}{6}$

A. $\frac{7}{12}$

B. $\frac{5}{12}$

C. $\frac{11}{12}$

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

73. A man sells a radio for N1, 200 at a loss of 20%. How much did he buy it?

    A. N1, 500
    B. N1, 440
    C. N1, 000
    D. N960

74. Express 0.0462 in standard form.

    A. 4.62×10^{-2}
    B. 4.62×10^{-3}
    C. 46.2×10^{-3}
    D. 4.62×10^{2}

75. If $\frac{2}{3}$ of a number is 30, what is $\frac{3}{5}$ of that number?

    A. 27
    B. 20
    C. 45
    D. 25

76. A discount of 15% on the marked price of an article amounts to N450. What is the marked price?

    A. N3, 000
    B. N3, 500
    C. N2, 500
    D. N4, 000

77. Evaluate: $(0.6)^2 - (0.4)^2$

    A. 0.2
    B. 0.4
    C. 0.52
    D. 0.36

78. A worker's salary was increased by 25%. If his new salary is N2, 500, what was his old salary?

    A. N2, 000
    B. N2, 250
    C. N1, 875
    D. N3, 125

79. Simplify: $\frac{0.0324 \times 0.00064}{0.48 \times 0.012}$

    A. 0.0036
    B. 0.036
    C. 0.36
    D. 3.6

80. What is the simple interest on N5, 000 for 3 years at 4% per annum?

    A. N600
    B. N500
    C. N650
    D. N750

81. If $x : y = 2 : 3$ and $y : z = 4 : 5$, find $x : z$.

    A. 8 : 15
    B. 10 : 15
    C. 8 : 12
    D. 6 : 15

82. Express $\frac{5}{8}$ as a decimal.

    A. 0.625
    B. 0.650
    C. 0.725
    D. 0.525

83. A man bought 20 articles at N50 each and sold them at N60 each. What is his percentage profit?

    A. 10%
    B. 20%
    C. 15%
    D. 25%

84. Evaluate: $2.5 \times 0.04 \times 0.5$

    A. 0.05
    B. 0.5
    C. 0.005
    D. 5.0

85. The HCF of 72, 96 and 108 is

    A. 12
    B. 24
    C. 18
    D. 36

86. Simplify: $3\frac{1}{4} \div 1\frac{1}{2}$

    A. $2\frac{1}{6}$
    B. $1\frac{5}{6}$
    C. $2\frac{1}{2}$

D. $4\frac{7}{8}$

87. A sum of N8, 000 is invested at 5% compound interest per annum. What is the amount after 2 years?

A. N8, 820

B. N8, 800

C. N8, 640

D. N9, 000

88. Express 0.0000375 in standard form.

A. 3.75×10^{-5}

B. 3.75×10^{-4}

C. 37.5×10^{-6}

D. 3.75×10^{5}

89. If $\frac{3}{4}$ of a class are girls and $\frac{2}{3}$ of the girls are tall, what fraction of the class are tall girls?

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

B. $\frac{5}{12}$

C. $\frac{2}{3}$

D. $\frac{1}{4}$

90. A man earns N15, 000 monthly. If 12% is deducted for tax, how much does he take home?

A. N13, 200

B. N13, 800

C. N14, 000

D. N13, 500

91. Evaluate: $\sqrt{0.0169}$

A. 0.13

B. 0.013

C. 1.3

D. 0.0013

92. Simplify: $\frac{3}{7} \times \frac{14}{9} \div \frac{2}{3}$

A. 1

B. 2

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

D. 3

93. What percentage of 250 is 75?

A. 30%

B. 25%

C. 20%

D. 35%

94. The LCM of 12, 18, and 24 is

A. 72

B. 144

C. 48

D. 36

95. A man bought a car for N800, 000 and sold it for N920, 000. What is his percentage gain?

A. 15%

B. 12%

C. 20%

D. 10%

96. Express $2\frac{3}{5}$ as a decimal.

A. 2.6

B. 2.3

C. 2.5

D. 2.8

97. If N1, 200 amounts to N1, 440 in 2 years at simple interest, what is the rate per annum?

A. 10%

B. 12%

C. 8%

D. 15%

98. Simplify: $\left(\frac{2}{3}\right)^2 + \left(\frac{1}{4}\right)^2$

A. $\frac{25}{36}$

B. $\frac{17}{36}$

C. $\frac{73}{144}$

D. $\frac{65}{144}$

99. A bag of rice costs N8, 000. If the price increases by 12.5%, what is the new price?

A. N9, 000

B. N9, 500

C. N8, 500

D. N10, 000

100. Evaluate: $4.8 \div 0.06$

A. 80

B. 8

C. 800

D. 0.8

Chapter 2

Algebra

2.1 Factorization and Remainder Theorem

2.1.1 Questions

1. If the function f is defined by $f(x+2) = 2x^2 + 7x - 5$, find $f(-1)$.

   A. -8

   B. 4

   C. 10

   D. -10

2. Factorize $a^2x - b^2y - b^2x + a^2y$.

   A. $(y-x)(a-b)(a+b)$

   B. $(a-b)(x+y)$

   C. $(x-y)(a-b)$

   D. $(x+y)(a-b)(a+b)$

3. If $x-1$ and $x+1$ are both factors of the equation $x^3 + px^2 + qx + 6 = 0$, evaluate p and q.

   A. $-6, -1$

   B. $1, -1$

   C. $6, 1$

   D. $6, -6$

4. If $f(x) = \dfrac{1}{x-1} + \dfrac{x-1}{x^2-1}$, find $f(1-x)$.

   A. $\dfrac{1}{x} + \dfrac{1}{x-2}$

   B. $-\dfrac{1}{x} - \dfrac{1}{x-2}$

   C. $x + \dfrac{1}{2x-1}$

   D. $\dfrac{1}{x} + \dfrac{1}{x^2-1}$

   E. $-\dfrac{1}{x} - \dfrac{1}{2x-1}$

5. Multiply $(x + 3y + 5)$ by $(2x^2 + 5y + 2)$.

   A. $2x^3 + 3x^2y + 10xy^2 + 13y + 10x^2 + 2x + 10$

   B. $2x^3 + 2x^2y + 10xy + 10y^2 + 31y + 5x^2 + 2x + 10$

   C. $2x^3 + 6x^2y + 5xy + 10y^2 + 13y + 5x^2 + 2x + 10$

   D. $2x^3 + 6x^2y + 5xy + 15y^2 + 31y + 5x^2 + 2x + 10$

   E. $2x^3 + 3x^2y + 5xy + 10y^2 + 13y + 5x^2 + 2x + 10$

6. If $kx^3 + 10x^2 + lx - 3$ is divisible by $(x-1)$ and when it is divided by $(x+2)$ the remainder is 27, find the constants k and l.

   A. $k = -7, l = -15$

   B. $k = \dfrac{-21}{5}, l = \dfrac{-61}{5}$

   C. $k = -15, l = -7$

   D. $k = -\dfrac{5}{3}, l = \dfrac{19}{5}$

   E. $k = -\dfrac{5}{3}, l = -\dfrac{19}{3}$

7. Factorize $3x^3 + 4x^2 - 13x + 6$ completely, given that $x - 1$ is a factor.

   A. $(x-1)(x-3)(x+2)$

   B. $(x-1)(x-3)(3x+2)$

   C. $(x-1)(x-2)(x+3)$

   D. $(x-1)(x+3)(3x+2)$

   E. $(x-1)(x+3)(3x-2)$

8. Multiply $x^2 + x + 1$ by $x^2 - x + 1$.

   A. $x^4 + 3x^2 + x + 1$

   B. $x^4 + 4x^2 - 6x + 1$

C. $x^4 + 4x^2 + 1$

D. $x^4 - x^3 - x^2 + x + 1$

E. $x^4 - 6x^2 - 4x + 1$

9. If $x = 1$ is a root of the equation $x^3 - 2x^2 - 5x + 6$, find the other roots.

A. -3 and 2

B. 1 and 3

C. -2 and 2

D. 3 and -2

E. -3 and 1

10. If $x + 2$ and $x - 1$ are factors of the expression $lx^3 + 2kx^2 + 24$, find the values of l and k.

A. $l = -6, k = -9$

B. $l = -2, k = -1$

C. $l = -2, k = 1$

D. $l = 0, k = 1$

E. $l = 6, k = 0$

11. Factorize completely: $81a^4 - 16b^4$.

A. $(3a + 2b)(2a - 3b)(9a^2 + 4b^2)$

B. $(3a - 2b)(2a - 3b)(9a^2 - 4b^2)$

C. $(3a - 2b)(3a - 2b)(9a^2 + 4b^2)$

D. $(3a - 2b)(2a - 3b)(4a^2 - 9b^2)$

E. $(3a - 2b)(3a + 2b)(9a^2 + 4b^2)$

12. The factor which is common to all three bionomial expressions $4a^2 - 9b^2$, $8a^2 + 27b^3$, $(4a + 6b)^2$ is:

A. $4a - 6b$

B. $4a + 6b$

C. $2a - 3b$

D. $2a + 3b$

E. $3a - 2b$

13. If $x - 2$ and $x + 1$ are factors of the expression $x^3 + px^2 + qx + 1$, find $p + q$.

A. -3

B. 0

C. $-\frac{17}{3}$

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

E. 3

14. The factors of $9 - \left(x^2 - 3x - 1\right)^2$ are:

A. $(x - 4)(x - 1)(x - 1)(x + 2)$

B. $(x - 4)(x + 1)(x - 2)(x - 1)$

C. $(x - 2)(x + 2)(x + 1)(x + 4)$

D. $(x - 2)(x + 2)(x + 1)(x - 1)$

E. $(x - 4)(x - 3)(x - 2)(x + 1)$

15. If $f(x - 2) = 4x^2 + x + 7$, find $f(1)$.

A. 27

B. 7

C. 17

D. 46

E. 12

16. If $g(y) = \frac{y - 3}{11} + \frac{11}{y^2 - 9}$ what is $g(y + 3)$?

A. $\frac{y}{11} + \frac{11}{y(y + 5)}$

B. $\frac{y + 30}{11} + \frac{11}{y(y + 3)}$

C. $\frac{y}{11} + \frac{11}{y(y + 3)}$

D. $\frac{y + 3}{11} + \frac{11}{y(y - 6)}$

17. Factorize completely $3a + 125a^3$.

A. $(2a + 5x)(4 + 10ax + 25ax^2)$

B. $(2a + 5x^2)(4 + 25ax)$

C. $a(2 + 5x)(4 - 10x + 25ax^2)$

D. $a(2 + 5x)(4 + 10ax + 25ax^2)$

18. Factorize $x^2 + 2a + ax + 2x$.

A. $(x^2 - 1)(x + a)$

B. $(x + 2)(x + a)$

C. $(x + 2a)(x + 3)$

D. $(x + 2a)(x - 1)$

19. The graphical method of solving the equation $x^3 + 3x^2 + 4x - 28 = 0$ is by drawing the graphs of the curves:

A. $y = x^3$ and $y = 3x^2 + x - 28$

B. $y = x^3 + 3x^2 + 4x$ and y

C. $y = x^3 + 3x^2 + 4x - 28$ and the line $y = \frac{28}{x}$

D. $y = x^2 + 3x + 4$ and $y = \frac{28}{x}$

E. $y = x^2 + 3x + 4$ and line $y = 28x$

20. Factorize $(4a + 3)^2 - (3a - 2)^2$.

A. $(x + 2a)(x - 1)$

B. $(x+1)(x+2a)$

C. $(x+2)(x+a)$

D. $(x^2-1)(x+a)$

21. If $x^3-12x-16=0$ has $x-2$ as a solution, then the equation has:

A. 3 roots all different

B. $x-4$ as a solution also

C. 3 roots all equal

D. 3 roots with two equal and the third different

E. only one root

22. The expression x^3-4x^2+cx+d is such that $x+1$ is a factor and its value is 1 when x is -2. Find c and d.

A. $c=-4$ and $d=9$

B. $c=20$ and $d=9$

C. $c=-20$ and $d=15$

D. $c=-20$ and $d=-15$

E. $c=20$ and $d=-15$

23. What factor is common to all the expressions $x+1$, $2x^2+x+1$, and x^2-1?

A. $x+1$

B. 1

C. No common factor

D. $2x-1$

E. x

24. Factorize completely: $(x^2+x)^2-(2x+2)^2$.

A. $(x+y)(x+2)(x-2)$

B. $(x+1)^2(x+2)(x-2)$

C. $(x+y)^2(y-2)^2$

D. $(x+1)^2(x+2)^2$

25. If $f(x)=2x^2+5x+3$, find $f(x+1)$.

A. $2x^2-x+10$

B. $2x^2-x$

C. $4x^2+3x+12$

D. $4x^2+3x+2$

26. If one factor of x^3-8^{-1} is $x-2^{-1}$, the other factor is:

A. $x^2+2^{-1}x-4^{-1}$

B. $x^2-2^{-1}x-4^{-1}$

C. $x^2-2^{-1}x-4^{-1}$

D. $x^2+4^{-1}x-2^{-1}$

27. Factorize $9(x+y)^2-4(x-y)^2$.

A. $(x+y)(5x+y)$

B. $(x+y)^2$

C. $5(x+y)^2$

D. $(x+5y)(5x-y)$

28. Factorize $4a^2-12ab-c^2+9b^2$.

A. $(2a+3b-c)(2a+3b+c)$

B. $4a(a-3b)+(3b-c)^2$

C. $(2a-3b-c)(2a-3b+c)$

D. $4a(a-3b)+(3b+c)^2$

29. What are the values of k and l respectively if $\frac{1}{2}(3y-4x)^2=(8x^2+kxy+ly^2)$.

A. $12, \frac{9}{2}$

B. $-12, \frac{9}{2}$

C. $6, 9$

D. $-6, 9$

30. If $f(x-4)=x^2+2x+3$, find $f(2)$.

A. 11

B. 6

C. 51

D. 27

31. Factorize completely: $y^3-4xy+xy^3-4y$.

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

B. $y(1+x)(y-2)(y-2)$

C. $(y+xy)(y+2)(y-2)$

D. $(y+xy)(y+2)(y-2)$

32. If $g(x)=x^2+3x+4$, find $g(x+1)-g(x)$.

A. $2(x+2)$

B. $(x+2)$

C. $(2x+1)$

D. x^2+4

33. Factorize: m^3-2m^2-m+2.

A. $(m+1)(m+1)(m+2)$

B. $(m^2+1)(m-2)$

C. $(m^2+2)(m-1)$

D. $(m-2)(m+1)(m-1)$

34. Which of the following is a factor of $rs+tr-pt-ps$?

A. $(p - s)$

B. $(r - p)$

C. $(s - p)$

D. $(r + p)$

35. If $x + 1$ is a factor of $x^3 + 3x^2 + kx + 4$, find the value of k.

A. -6

B. 6

C. 8

D. -8

36. Factorize: $9p^2 - q^2 + 6qr - 9r^2$.

A. $(3p - 3q + r)(3p - q)$

B. $(6p - 3q - 3r)(3p - q - 4r)$

C. $(3p - 3q + r)(3p - q - 3r)$

D. $(3p - 3q + r)(3p - q + 4r)$

37. If a function is defined by $f(x + 1) = 3x^2 - x + 4$, find $f(0)$.

A. 6

B. 8

C. 0

D. 2

E. 4

38. If $f(x + 2) = 3x^2 + 4x + 1$, find the value of $f(1)$.

A. 32

B. 40

C. 8

D. 32

E. 21

39. Factorize: $6x^2 - 14x - 12$.

A. $2(x + 3)(3x - 2)$

B. $2(x - 3)(3x + 2)$

C. $6(x - 2)(x + 1)$

D. $6(x + 2)(x - 1)$

E. $(3x + 4)(2x + 3)$

40. Factorize: $abx^2 + 8y - 4bx - 2axy$.

A. $(ax - 4)(bx - 2y)$

B. $(bx - 4)(ax - 2y)$

C. $(ax + b)(x - 8y)$

D. $(x - 2y)(abx - 4)$

E. $(ax - 2y)(by - 4)$

41. Factorize: $1 - (a - b)^2$.

A. $(1 + a + b)(1 - a - b)$

B. $(1 - a + b)(1 + a - b)$

C. $(1 + a - b)(1 - a + b)$

D. $(1 - a - b)(1 - a + b)$

E. $(1 - a + b)(1 + a + b)$

42. Which of the following is a factor of $15 + 7x - 2x^2$?

A. $x + 3$

B. $x - 5$

C. $x + 5$

D. $x - 3$

43. Divide the expression $x^3 + 7x^2 - x - 7$ by $-1 + x^2$.

A. $x + 7$

B. $-x^3 + 7x^2 - x - 7$

C. $x - 7$

D. $-x^2 + 7x + 7$

44. Find a positive value of p if the expression $2x^2 - px + p$ leaves a remainder 6 when divided by $x - p$.

A. 1

B. 2

C. 3

D. 4

45. When the expression $pm^2 + qm + 1$ is divided by $(m - 1)$, it has a remainder of 2 and when divided by $(m + 1)$ the remainder is 4, find p and q respectively.

A. $-2, 3$

B. $2, -1$

C. $-1, 2$

D. $3, -2$

46. Factorize: $r^2 - r(2p + q) + 2pq$.

A. $(r - q)(r - 2p)$

B. $(r - 2q)(2r - p)$

C. $(2r - p)(r + p)$

D. $(r - p)(r + q)$

47. Divide $2x^3 + 11x^2 + 17x + 6$ by $2x + 1$.

A. $x^2 + 5x + 6$

B. $x^2 - 5x + 6$

C. $2x^2 + 5x + 6$

D. $x^2 + 5x + 6$

48. Factorize completely: $x^2 + 2xy + y^2 + 3x + 3y - 18$.

A. $(x + y + 6)(x + y - 3)$

B. $(x - y - 6)(x - y + 3)$

C. $(x - y + 6)(x - y - 3)$

D. $(x + y - 6)(x + y + 3)$

49. Divide $4x^3 - 3x + 1$ by $2x - 1$.

A. $2x^2 - x + 1$

B. $2x^2 + x - 1$

C. $2x^2 - x - 1$

D. $2x^2 + x + 1$

50. If $(x - 1)$, $(x + 1)$ and $(x - 2)$ are factors of the polynomial $ax^3 + bx^2 + cx - 1$, find a, b, and c respectively.

A. $\frac{-1}{2}, 1, \frac{1}{2}$

B. $\frac{1}{2}, 1, \frac{1}{2}$

C. $\frac{1}{2}, -1, \frac{1}{2}$

D. $\frac{1}{2}, 1, 1\frac{1}{2}$

51. Factorize: $4x^2 - 9y^2 + 20x + 25$.

A. $(2x - 3y + 5)(2x - 3y - 5)$

B. $(2x - 3y + 5)(2x + 3y + 5)$

C. $(2x + 3y - 5)(2x + 3y + 5)$

D. $(2x + 3y - 5)(2x - 3y - 5)$

E. $(2x - 3y + 5)(2x - 3y - 5)$

52. Divide $a^{3x} - 26a^{2x} + 156a^x - 216$ by $a^{2x} - 24a^x + 108$.

A. $a^x + 2$

B. $a^x - 2$

C. $a^x - 18$

D. $a^x - 6$

53. Find the values of x where the curve $y = x^3 + 2x^2 - 5x - 6$ crosses the x-axis:

A. $2, -1$ and -3

B. $2, 1$ and 3

C. $2, 1$ and -3

D. $2, -1$ and 3

54. The polynomial whose roots are $\frac{4}{3}$ and $-\frac{3}{5}$ is:

A. $15x^2 - 11x - 12$

B. $12x^2 + 11x - 15$

C. $12x^2 - x - 12$

D. $15x^2 + 11x - 12$

55. If $9x^2 + 6xy + 4y^2$ is a factor of $27x^3 - 8y^3$, find the other factor.

A. $2y + 3x$

B. $2y - 3x$

C. $3x + 2y$

D. $3x - 2y$

56. Factorize completely: $\frac{x^3 + 3x^2 - 10x}{2x^2 - 8}$.

A. $\frac{x(x - 5)}{2(x - 2)}$

B. $\frac{x(x - 5)}{2(x + 2)}$

C. $\frac{x(x + 5)}{2(x + 2)}$

D. $\frac{x^2 + 5}{2x + 4}$

57. Find the remainder when $3x^3 + 5x^2 + 11x - 4$ is divided by $x + 3$.

A. 1

B. 4

C. -4

D. -1

58. Factorize completely: $ac - 2bc + a^2 + 4b^2$.

A. $(a - 2b)(c + a - 2b)$

B. $(a - 2b)(c - a + 2b)$

C. $(a - 2b)(c + a + 2b)$

D. $(a - 2b)(c - a - 2b)$

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

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

B. $(2y - 3x)(y - 6x)$

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

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

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

A. -6

B. -4

C. 0

D. 1

61. Divide $6x^2 + 13x + 5$ by $2x + 1$.

A. $3x - 5$

B. $3x + 5$

C. $5x - 3$

D. $5x + 3$

62. The polynomial whose roots are -2, -1 and 3 is:

A. $x^3 - 7x + 6$

B. $x^3 + 7x - 6$

C. $x^3 - 7x - 6$

D. $x^3 + 7x + 6$

63. Find the value of k if the expression $kx^3 + x^2 - 5x - 2$ leaves a remainder of 2 when divided by $2x + 1$.

A. 10

B. -8

C. -10

D. 8

64. Find the roots of $x^3 - 2x^2 - 5x + 6 = 0$.

A. $-1, -2, 3$

B. $-1, 2, -3$

C. $1, 2, -3$

D. $1, -2, 3$

65. Factorize: $2t^2 + t - 15$.

A. $(t + 3)(2t - 5)$

B. $(2t + 3)(t - 5)$

C. $(t + 3)(t - 5)$

D. $(2t - 3)(t + 5)$

66. If $2x^2 - kx - 12$ is divisible by $x - 4$, find the value of k.

A. 4

B. 5

C. 6

D. 7

67. Solve for x in the equation $x^3 - x + 5 = 0$.

A. $-1, 1, -5$

B. $1, 1, 5$

C. $1, 1, -5$

D. $1, -1, 5$

68. Find the remainder when $x^3 - 2x^2 + 3x - 3$ is divided by $x^2 + 1$.

A. $2x - 1$

B. $x + 3$

C. $2x + 1$

D. $3x - 3$

69. Find the remainder when $2x^3 - 11x^2 + 8x - 1$ is divided by $x + 3$.

A. -871

B. -781

C. -187

D. -178

70. Factorize: $(2x+3y)^2+2(2x+3y)(2x-3y)+(2x-3y)^2$.

A. $16x^2$

B. $18x^2$

C. $12x^2$

D. none of the above

71. Factorize: $45a^3b + 5ab^3 - 30a^2b^2$.

A. $5ab(3a - b)^2$

B. $7ab(5a - b)^2$

C. $5ab(5a - b)^2$

D. none of the above

72. Find the factors of $(a - b)^3 + (b - c)^3 + (c - a)^3$.

A. $3(a + b)(b + c)(c + a)$

B. $3(a - b)(b - c)(c - a)$

C. $5(a - b)(b - c)(c - a)$

D. $5(a + b)(b - c)(c - a)$

73. Factorize: $a^2 + \frac{1}{a^2} + 3 - 2a - \frac{2}{a}$.

A. $\left(a + \frac{1}{a} - 1\right)\left(a - \frac{1}{a} + 1\right)$

B. $\left(a + \frac{1}{a} + 1\right)\left(a + \frac{1}{a} + 1\right)$

C. $\left(a + \frac{1}{a} + 1\right)\left(a + \frac{1}{a} - 1\right)$

D. $\left(a + \frac{1}{a} - 1\right)\left(a + \frac{1}{a} - 1\right)$

74. Resolve into factors: $9(3x + 5y)^2 - 12(3x + 5y)(2x + 3y) + 4(2x + 3y)^2$.

A. $(5x + 9y)$

B. $(5x - 9y)^2$

C. $(7x + 9y)^2$

D. None of the above

75. Factorize: $(a - b + c)^2 + (b - c + a)^2 + 2(a - b + c)(b - c + a)$.

A. $6a^2$

B. $4a^2$

C. $8a^2$

D. $10a^2$

76. Resolve into factors: $81x^2y^2 - 108xyz + 36z^2$.

A. $(6xy + 9z)^2$

B. $(9xy - 7z)^2$

C. $(9xy + 6z)^2$

D. $(6xy - 7z)^2$

77. What value should a possess so that $x + 1$ may be a factor of the polynomial

$$f(x) = 2x^3 - ax^2 - (2a - 3)x + 2$$

A. 3

B. 2

C. -2

D. none of the above

78. If $(x-2)$ is a factor of the polynomial x^3-2ax^2+ax-1, find the value of a.

A. $\frac{5}{6}$

B. $\frac{7}{6}$

C. $\frac{11}{6}$

D. none of the above

79. The remainder when $6p^3 - p^2 - 47p + 30$ is divided by $p - 3$ is:

A. 21

B. 63

C. 18

D. 42

80. Factorize: $k^2 - 2kp + p^2$.

A. $(k + p)^2$

B. $(k - p)^2$

C. $k^2 - p^2$

D. $k^2 + p^2$

81. If $x + 1$ is a factor of $x^3 + 3x^2 + mx + 4$, find the value of m.

A. 8

B. -6

C. 6

D. -8

82. Divide the expression $x^3 + 7x^2 - x - 7$ by $x^2 - 1$.

A. $x - 1$

B. $x + 1$

C. $x - 7$

D. $x + 7$

83. If $x+a$ is a factor of the polynomial $x^3+ax^2-2x+a+4$, find the value of a.

A. $-\frac{4}{3}$

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

C. $\frac{2}{3}$

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

84. Resolve into factors: $16x^2 - 72xy + 81y^2 - 12x + 27y$.

A. $(6x - 7y)(6x - 7y - 5)$

B. $(6x - 7y)(6x - 7y + 5)$

C. $(4x + 9y)(4x + 9y + 3)$

D. $(4x - 9y)(4x - 9y - 3)$

85. Resolve into factors: $16(x - y)^2 - 9(x + y)^2$.

A. $(x - 5y)(5x - y)$

B. $(x + 7y)(7x + y)$

C. $(x - 7y)(7x - y)$

D. $(x + 5y)(5x + y)$

86. Factorize the expression: $a^2 + \frac{1}{4} + a$.

A. $\left(a + \frac{1}{2}\right)\left(a - \frac{1}{2}\right)$

B. $\left(a + \frac{1}{2}\right)^2$

C. $\left(a + \frac{1}{2}\right)^3$

D. $\left(a + \frac{1}{2}\right) \cdot a$

87. Resolve into factors: $(a + b)^2 - 2(a^2 - b^2) + (a - b)^2$.

A. $6b^2$

B. $4b^2$

C. $2b^2$

D. $8b^2$

88. Factorize the expression: $(a+b)^2 - 14c(a+b) + 49c^2$.

A. $(a-b-9c)^3$

B. $(a+b+9c)^2$

C. $(a+b-7c)^2$

D. none of the above

89. When a polynomial $f(x)$ is divided by $x-3$ and $x+6$, the respective remainders are 7 and 22. What is the remainder when $f(x)$ is divided by $(x-3)(x+6)$?

A. $-\frac{5}{3}x + 12$

B. $-\frac{7}{3}x + 14$

C. $-\frac{5}{3}x + 16$

D. $-\frac{7}{3}x + 12$

90. When $4x^3 - ax^2 + bx + 4$ is divided by $x-2$ and $x+1$, the respective remainders are 20 and -13. Find the values of a and b.

A. $a = 3, b = 2$

B. $a = 9, b = 8$

C. $a = 7, b = 6$

D. $a = 5, b = 4$

91. When $(x^3 - 2x^2 + px - q)$ is divided by $x^2 - 2x - 3$ the remainder is $(x-6)$. The values of p and q are:

A. $p = -2, q = -6$

B. $p = 2, q = -6$

C. $p = 2, q = 6$

D. $p = -2, q = 6$

92. If $(x-1)$ is a factor of $ax^3 + bx^2 - 36x + 22$ and $2^b = 64^a$, find a and b.

A. $a = 4, b = 16$

B. $a = 6, b = 24$

C. $a = 2, b = 12$

D. $a = 8, b = 16$

93. If $2apq = (p+q)^2 - (p-q)^2$, then the value of a is:

A. 1

B. 2

C. 4

D. 8

94. What is the value of $\dfrac{(a^2+b^2)(a-b) - (a-b)^3}{a^2b - ab^2}$?

A. -1

B. -2

C. 1

D. 2

95. Find the values of m and n in the polynomial $2x^3 + mx^2 + nx - 14$, such that $(x-1)$ and $(x+2)$ are its factors.

A. $m = 4, n = 5$

B. $m = 9, n = 3$

C. $m = 6, n = 7$

D. none of the above

96. Divide the polynomial $4y^3 - 3y^2 + 2y - 4$ by $y+2$ and find the quotient and remainder.

A. $4y^2 - 11y + 24, -52$

B. $6y^2 - 13y + 36, -64$

C. $4y^2 + 13y - 24, 52,$

D. none of the above

97. Suppose that b and c are constants and

$$(x+2)(x+b) = x^2 + cx + 6$$

what is c?

A. -5

B. -3

C. -1

D. 3

E. 5

98. Simplify the expression: $x^3 + 3x + \frac{3}{x} + \frac{1}{x^3}$.

A. $\left(x - \frac{1}{3}\right)^3$

B. $\left(x - \frac{1}{x}\right)^3$

C. $\left(x - \frac{3}{x}\right)^3$

D. $\left(x + \frac{1}{x}\right)^3$

99. If $(x^{3/2} - xy^{1/2} + x^{1/2}y - y^{3/2})$ is divided by $(x^{1/2} - y^{1/2})$, the quotient is:

A. $x^{1/2} + y^{1/2}$

B. $x^2 - y^2$

C. $x - y$

D. $x + y$

100. Let $f(x) = a_0x^n + a_1x^{n-1} + a_2x^{n-2} + \cdots + a_{n-1}x + a_n$, where $a_0, a_1, a_2, \ldots, a_n$ are constants. If $f(x)$ is divided by $ax - b$, then the remainder is:

A. $f\left(\frac{b}{a}\right)$

B. $f\left(\frac{-b}{a}\right)$

C. $f\left(\frac{a}{b}\right)$

D. $f\left(\frac{-a}{b}\right)$

2.2 Indices and Standard Form

2.2.1 Questions

1. If $(25)^{x-1} = 64\left(\frac{5}{2}\right)^6$, then x has the value:

   A. 7

   B. 4

   C. 32

   D. 5

   E. 64

2. Simplify: $\frac{5^x \times 25^{x-1}}{125^{x+1}}$.

   A. 5^{x+2}

   B. 5^{2x-1}

   C. 5^{x+1}

   D. 5^3

   E. 5^{-5}

3. Express 37.05×0.0042 in standard form.

   A. 15.561×10^2

   B. 1.556×10^1

   C. 1.5561×10^{-4}

   D. 1.5561×10^{-1}

   E. 1.5561×10^2

4. Simplify: $\sqrt[3]{(64r^{-6})^{\frac{1}{2}}}$

   A. $\frac{1}{2r}$

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

   C. 2

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

5. What are the values of y that satisfy this equation:

$$9^y - 4(3^y) + 3 = 0$$

   A. -1 and 0

   B. 1 and 3

   C. 0 and 1

   D. -1 and 1

6. Simplify: $\frac{9^{\frac{1}{3}} \times 27^{-\frac{1}{2}}}{3^{-\frac{1}{6}} \times 3^{-\frac{2}{3}}}$

   A. $\frac{1}{3}$

   B. $\frac{1}{9}$

   C. 3

   D. 1

   E. 9

7. If $\sqrt{3^x} = \sqrt[3]{9}$

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

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

   C. $\frac{1}{3}$

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

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

8. Find the value of $\left(4^{\frac{1}{2}}\right)^6$

   A. 6

   B. 2

   C. 1

   D. 4

   E. 8

9. Simplify: $\dfrac{3(2^{n-1}) - 4(2^{n-1})}{2^{n+1} - 2^n}$

   A. -2^{n-1}

   B. 2^{n+1}

   C. -2^1

   D. -2^{-1}

10. Evaluate: $\dfrac{27^{\frac{1}{3}} - 8^{\frac{2}{3}}}{16^{\frac{2}{4}} \times 2}$

    A. $-\dfrac{1}{8}$

    B. $\dfrac{21}{7}$

    C. $\dfrac{23}{5}$

    D. $-\dfrac{23}{5}$

    E. $-\dfrac{23}{6}$

11. If $\dfrac{4^{x+3}}{16^{2x-3}} = 1$, find x

    A. 1

    B. -1

    C. -3

    D. 3

    E. -3

12. Evaluate without using tables: $(0.008)^{-\frac{1}{3}} \times (0.16)^{-\frac{3}{2}}$

    A. $\dfrac{8}{625}$

    B. 8

    C. $\dfrac{625}{8}$

    D. $\dfrac{1}{8}$

13. Simplify: $\dfrac{3^n - 3^{n-1}}{3^3 \times 3^n - 27 \times 3^{n-1}}$

    A. 0

    B. $\dfrac{1}{27}$

    C. $3^n - 3^{n-1}$

    D. 1

    E. $\dfrac{2}{27}$

14. Evaluate and leave your answer in standard form:

$$\sqrt{\frac{0.0048 \times 0.81 \times 10^{-7}}{0.027 \times 0.04 \times 10^{6}}}$$

    A. 6×10^{-14}

    B. 6×10^{-7}

    C. 6×10^{7}

    D. 6×10^{14}

15. If $3^{2y} - 6(3^y) = 27$, find y.

    A. 3

    B. -1

    C. 2

    D. -3

    E. 1

16. If it is given that $5^{x+1} + 5^x = 150$, then the value of x is equal to:

    A. 2

    B. 3

    C. $\dfrac{1}{2}$

    D. 1

    E. 4

17. Given that $10^{2n+1} = 0.0000001$, find n.

    A. -7

    B. -6

    C. $-\dfrac{3}{4}$

    D. 4

    E. -4

18. The result of dividing $\left(\dfrac{x^a}{x^b}\right)^{a-b}$ by $\left(\dfrac{x^{a+b}}{x^{a-b}}\right)^{\frac{a^2}{b}}$ is:

    A.

    B.

    C.

    D.

19. If $\sqrt[3]{81} = 3^x$, find the value of x.

    A. $\dfrac{4}{3}$

    B. $-\dfrac{4}{3}$

    C. $\dfrac{3}{4}$

D. $-\frac{3}{4}$

20. Simplify: $\frac{x(x+1)^{-\frac{1}{2}} - (x+1)^{\frac{1}{2}}}{(x+1)^{\frac{1}{2}}}$.

A. $\frac{1}{x+1}$

B. $-\frac{1}{x+1}$

C. $\frac{1}{x}$

D. $-\frac{1}{\sqrt{x+1}}$

21. Express in standard form:

$$\frac{0.8 \times 0.8 \times 0.8 - 0.5 \times 0.5 \times 0.5}{0.8 \times 0.8 + 0.8 \times 0.5 + 0.5 \times 0.5}$$

A. 8×10^{-1}

B. 4×10^{-1}

C. 3×10^{-1}

D. 1.3×10^{-1}

22. Express in standard form:

$$\frac{69842 \times 69842 - 30158 \times 30158}{69842 - 30158}$$

A. 3.0158×10^{-4}

B. 10^{-4}

C. 6.9842×10^{-5}

D. 10^{-5}

E. 10^{5}

23. The value of $\frac{9^2 \times 18^4}{3^{16}}$ is:

A. $\frac{2}{3}$

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

C. $\frac{32}{243}$

D. $\frac{16}{81}$

24. If m and n are whole numbers such that $m^n = 121$, then $(m-1)^{n+1}$ is:

A. 10

B. 10^2

C. 10^3

D. 10^4

25. Simplify: $\frac{a^{\frac{1}{2}} + a^{-\frac{1}{2}}}{1-a} + \frac{1 - a^{\frac{1}{2}}}{1 + \sqrt{a}}$.

A. $\frac{a}{a-1}$

B. $\frac{a-1}{2}$

C. $\frac{2}{a-1}$

D. $\frac{2}{1-a}$

26. Simplify: $\left(\frac{1}{64}\right)^0 + (64)^{-\frac{1}{2}} + (-32)^{\frac{4}{5}}$.

A. $17\frac{1}{8}$

B. $11\frac{7}{8}$

C. $17\frac{3}{8}$

D. $17\frac{7}{8}$

27. If $\left(\frac{x}{y}\right)^{5a-3} = \left(\frac{y}{x}\right)^{17-3a}$, what is the value of a?

A. -7

B. -5

C. 0

D. 3

28. Evaluate: $\frac{(0.064 - 0.008)(0.16 - 0.04)}{(0.16 + 0.08 + 0.04)(0.4 + 0.2)^3}$.

A. $\frac{1}{3}$

B. 3

C. $\frac{3}{2}$

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

29. The value of $\left[\left(\sqrt[n]{x^2}\right)^{n/2}\right]^2$ is:

A. $\frac{1}{x^2}$

B. x

C. x^2

D. $x^{\frac{n}{2}}$

30. Solve for x if $3^x - 3^{x-1} = 486$.

    A. 5
    B. 6
    C. 7
    D. 9

31. If $5\sqrt{5} \times 5^3 \div 5^{-\frac{3}{2}} = 5^{a+2}$, then the value of a is:

    A. 4
    B. 5
    C. 6
    D. 8

32. If $\left(\sqrt{3}\right)^5 \times 9^2 = 3^n \times 3\sqrt{3}$, find n.

    A. 2
    B. 3
    C. 4
    D. 5

33. The value of $\dfrac{243^{\frac{n}{5}} \times 3^{2n+1}}{9^n \times 3^{n-1}}$ is:

    A. 3
    B. 6
    C. 9
    D. 12

34. If $k^a k^b k^c = 1$, then the value of $a^3 + b^3 + c^3$ is:

    A. 9
    B. $a + b + c$
    C. abc
    D. $3abc$

35. The value of $\dfrac{81^{3.6} \times 9^{2.7}}{81^{4.2} \times 3}$ is:

    A. 3
    B. 6
    C. 9
    D. 8.2

36. Simplify: $\dfrac{6^{2n+1} \times 9^n \times 4^{2n}}{18^n \times 2^n \times 12^{2n}}$.

    A. 3^{2n}
    B. $3 \times 2^{n+1}$
    C. $2n$
    D. 6
    E. 1

37. Solve the system of equations: $2^{x+y} = 32$ and $3^{3y-x} = 27$. Find (x, y).

    A. $(-3, 2)$
    B. $(-3, -2)$
    C. $(3, 2)$
    D. $(2, 2)$
    E. $(3, -2)$

38. Evaluate: $256^{\frac{3}{4}} \times 256^{-\frac{1}{4}}$.

    A. 4
    B. 8
    C. 16
    D. 64

39. If $8^x = \dfrac{1}{4}$, find the value of x.

    A. $-\dfrac{2}{3}$
    B. $-\dfrac{1}{2}$
    C. $\dfrac{1}{3}$
    D. $\dfrac{2}{3}$

40. Simplify: $\dfrac{2^{-3} \times 8^2}{4^{-1}}$.

    A. 16
    B. 32
    C. 64
    D. 128

41. If $27^{x+2} = 9^{2x-3}$, find x.

    A. 9
    B. 12
    C. 15
    D. 18

42. Evaluate: $(0.25)^{-\frac{1}{2}}$.

    A. $\dfrac{1}{4}$
    B. $\dfrac{1}{2}$
    C. 2
    D. 4

43. Express 0.000215 in standard form.

A. 2.15×10^{-4}

B. 2.15×10^{-3}

C. 21.5×10^{-5}

D. 2.15×10^{4}

44. If $2^{x-1} \times 4^{x+1} = 8^{x}$, find x.

A. 1

B. 2

C. 3

D. 4

45. Simplify: $\dfrac{16^{\frac{3}{4}} \times 2^{3}}{4^{\frac{1}{2}}}$.

A. 8

B. 16

C. 32

D. 64

46. If $(0.5)^{1-x} = 8$, find x.

A. -4

B. -2

C. 2

D. 4

47. Express in standard form: $\dfrac{0.00056 \times 3500}{0.07 \times 0.004}$.

A. 7×10^{3}

B. 7×10^{2}

C. 7×10^{-3}

D. 7×10^{-2}

48. Evaluate: $27^{\frac{2}{3}} - 16^{\frac{3}{4}}$.

A. 1

B. 2

C. 3

D. 4

49. If $5^{2x-3} = 125$, find x.

A. 2

B. 3

C. 4

D. 5

50. Simplify: $(81)^{\frac{3}{4}} \times (81)^{-\frac{1}{4}}$.

A. 3

B. 9

C. 27

D. 81

51. Express $3,450,000$ in standard form.

A. 3.45×10^{5}

B. 3.45×10^{6}

C. 34.5×10^{5}

D. 345×10^{4}

52. If $\dfrac{9^{x}}{3^{2x-1}} = 27$, find x.

A. 1

B. 2

C. 3

D. 4

53. Evaluate: $\left(\dfrac{1}{125}\right)^{-\frac{2}{3}}$

A. 5

B. 25

C. 125

D. 625

54. Simplify: $2^{n+1} - 2^{n}$

A. 2^{n}

B. 2^{n-1}

C. 2

D. 1

55. If $4^{x+1} = 8^{x-2}$, find x

A. 5

B. 6

C. 7

D. 8

56. Express 0.000000482 in standard form

A. 4.82×10^{-7}

B. 4.82×10^{-6}

C. 48.2×10^{-8}

D. 482×10^{-9}

57. Evaluate: $\dfrac{8^{\frac{2}{3}} \times 4^{\frac{1}{2}}}{2^{3}}$

A. $\dfrac{1}{2}$

B. 1

C. 2

D. 4

58. If $2^x + 2^{x+1} = 48$, find x

A. 3

B. 4

C. 5

D. 6

59. Simplify: $\dfrac{625^{\frac{1}{4}} \times 125^{\frac{1}{3}}}{5^2}$

A. 1

B. 5

C. 25

D. 125

60. Express in standard form: $(3.5 \times 10^4) \times (2 \times 10^{-3})$

A. 7×10^1

B. 7×10^{-1}

C. 7×10^2

D. 7×10^7

61. If $16^{x-\frac{1}{2}} = 4^{2x}$, find x

A. -1

B. $-\dfrac{1}{2}$

C. $\dfrac{1}{2}$

D. 1

62. Evaluate: $49^{\frac{1}{2}} - 32^{\frac{2}{5}}$

A. 1

B. 2

C. 3

D. 4

63. Simplify: $\dfrac{3^{n+2} - 3^n}{3^{n+1}}$

A. $\dfrac{8}{3}$

B. 2

C. 3

D. 8

64. If $\sqrt[3]{8^x} = 4$, find x

A. 1

B. 2

C. 3

D. 4

65. Express $\dfrac{7200000}{0.0024}$ in standard form

A. 3×10^9

B. 3×10^{10}

C. 3×10^8

D. 3×10^7

66. Evaluate: $(64)^{-\frac{2}{3}} + (27)^{-\frac{1}{3}}$

A. $\dfrac{1}{3}$

B. $\dfrac{5}{12}$

C. $\dfrac{7}{12}$

D. 1

67. If $25^{1-x} = \dfrac{1}{125}$, find x

A. $\dfrac{5}{2}$

B. $\dfrac{3}{2}$

C. 2

D. $\dfrac{7}{2}$

68. Simplify: $\left(8^{-1} \times 2^5\right)^2$

A. 4

B. 8

C. 16

D. 32

69. Express in standard form: $\dfrac{8.4 \times 10^6}{2.1 \times 10^{-3}}$

A. 4×10^9

B. 4×10^8

C. 4×10^{10}

D. 4×10^3

70. If $3^{2x+1} = 27^{x-1}$, find x

A. -2

B. -3

C. -4

D. -5

71. Evaluate: $\left(\frac{16}{81}\right)^{-\frac{3}{4}}$

A. $\frac{8}{27}$

B. $\frac{27}{8}$

C. $\frac{2}{3}$

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

72. Simplify: $5^{n-1} + 5^{n+1}$

A. $\frac{26}{5} \times 5^n$

B. $26 \times 5^{n-1}$

C. 5^{2n}

D. 2×5^n

73. If $\sqrt{32^x} = 8$, find x

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

B. $\frac{2}{5}$

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

D. $\frac{1}{5}$

74. Express $562,000 \times 0.00003$ in standard form

A. 1.686×10^1

B. 1.686×10^{-1}

C. 16.86×10^0

D. 1.686×10^2

75. Evaluate: $100^{\frac{3}{2}} - 64^{\frac{1}{2}}$

A. 992

B. 936

C. 1000

D. 994

76. If $7^{x+2} = \frac{1}{49}$, find x

A. -4

B. -3

C. -2

D. -1

77. Simplify: $\frac{2^{2n} \times 4^n}{8^n}$

A. 1

B. 2

C. 2^n

D. 4^n

78. Express in standard form: $\sqrt{0.000144}$

A. 1.2×10^{-2}

B. 1.2×10^{-1}

C. 12×10^{-3}

D. 1.2×10^{-3}

79. If $4^{3x-2} = 64^{x+1}$, find x

A. 2

B. 3

C. 4

D. 5

80. Evaluate: $(0.04)^{-\frac{3}{2}}$

A. 125

B. 25

C. 5

D. 625

81. Simplify: $\frac{(x^2)^3 \times x^{-4}}{x^3}$

A. x

B. x^{-1}

C. x^2

D. x^{-2}

82. If $9^{x-1} = 3^{x+3}$, find x

A. 3

B. 4

C. 5

D. 6

83. Express in standard form: $\frac{0.0081 \times 0.012}{0.027}$

A. 3.6×10^{-3}

B. 3.6×10^{-2}

C. 36×10^{-4}

D. 3.6×10^{-4}

84. Evaluate: $243^{\frac{2}{5}} \times 32^{\frac{3}{5}}$

A. 48

B. 54

C. 72

D. 36

85. If $2^{x-y} = 8$ and $2^{x+y} = 32$, find x

A. 3

B. 4

C. 5

D. 6

86. Simplify: $\dfrac{a^{\frac{1}{3}} \times a^{\frac{2}{3}}}{a^{-\frac{1}{2}}}$

A. $a^{\frac{1}{2}}$

B. $a^{\frac{3}{2}}$

C. a^2

D. a

87. If $\sqrt[4]{16^x} = 8$, find x

A. 2

B. 3

C. 4

D. 5

88. Express in standard form: $(6 \times 10^5) \div (3 \times 10^{-2})$

A. 2×10^7

B. 2×10^6

C. 2×10^3

D. 2×10^{-7}

89. Evaluate: $125^{\frac{2}{3}} - 36^{\frac{1}{2}}$

A. 13

B. 19

C. 21

D. 25

90. If $5^{2x} - 7(5^x) + 10 = 0$, find x

A. 0 or 1

B. 1 or 2

C. 0 or 2

D. 1 or $\log_5 2$

91. Simplify: $\dfrac{10^{n+2} - 10^n}{99 \times 10^n}$

A. 1

B. 10

C. $\dfrac{1}{10}$

D. 99

92. If $(0.125)^x = 8$, find x

A. -1

B. -2

C. -3

D. 3

93. Express in standard form: $\sqrt{6.4 \times 10^{-5}}$

A. 8×10^{-3}

B. 8×10^{-2}

C. 2.53×10^{-3}

D. 2.53×10^{-2}

94. Evaluate: $\left(27^{\frac{1}{3}} + 8^{\frac{1}{3}}\right)^2$

A. 25

B. 49

C. 64

D. 81

95. If $3^{x+1} + 3^{x-1} = 90$, find x

A. 2

B. 3

C. 4

D. 5

96. Simplify: $\left(\dfrac{125}{8}\right)^{-\frac{2}{3}} \times \left(\dfrac{25}{4}\right)^{\frac{1}{2}}$

A. 1

B. 2

C. 3

D. 4

97. If $2^a = 3$ and $2^b = 5$, find 2^{2a+b}

A. 15

B. 30

C. 45

D. 60

98. Express $\dfrac{72 \times 10^{-5} \times 25 \times 10^3}{18 \times 10^{-2}}$ in standard form

A. 1×10^1

B. 1×10^2

C. 1×10^3

D. 1×10^4

99. If $4^{x+2} - 4^x = 240$, find x

A. 1

B. 2

C. 3

D. 4

100. Simplify: $\frac{(2^{n+1})^2 \times 4^{n-1}}{8^n}$

A. 2

B. 4

C. 8

D. 2^n

2.3 Surds

2.3.1 Questions

1. Simplify: $\sqrt{50}$

A. $5\sqrt{2}$

B. $2\sqrt{5}$

C. $10\sqrt{2}$

D. $25\sqrt{2}$

2. Simplify: $\sqrt{75} + \sqrt{12}$

A. $7\sqrt{3}$

B. $5\sqrt{3} + 2\sqrt{3}$

C. $\sqrt{87}$

D. $8\sqrt{3}$

3. Rationalize the denominator: $\frac{6}{\sqrt{3}}$

A. $2\sqrt{3}$

B. $3\sqrt{2}$

C. $6\sqrt{3}$

D. $\sqrt{18}$

4. Simplify: $\sqrt{128}$

A. $8\sqrt{2}$

B. $4\sqrt{8}$

C. $16\sqrt{2}$

D. $2\sqrt{32}$

5. Evaluate: $(\sqrt{5})^2$

A. 25

B. 5

C. 10

D. $\sqrt{25}$

6. Simplify: $\sqrt{18} - \sqrt{8}$

A. $\sqrt{10}$

B. $\sqrt{2}$

C. $2\sqrt{2}$

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

7. Multiply: $\sqrt{3} \times \sqrt{12}$

A. 6

B. $3\sqrt{4}$

C. $\sqrt{36}$

D. $2\sqrt{6}$

8. Rationalize: $\frac{10}{\sqrt{5}}$

A. $2\sqrt{5}$

B. $5\sqrt{2}$

C. $\sqrt{20}$

D. $10\sqrt{5}$

9. Simplify: $3\sqrt{8} + 2\sqrt{2}$

A. $5\sqrt{10}$

B. $8\sqrt{2}$

C. $5\sqrt{2}$

D. $6\sqrt{2} + 2\sqrt{2}$

10. Express in simplest form: $\sqrt{200}$

A. $10\sqrt{2}$

B. $20\sqrt{2}$

C. $100\sqrt{2}$

D. $2\sqrt{100}$

11. Simplify: $\frac{\sqrt{48}}{\sqrt{3}}$

A. 4

B. 16

C. $\sqrt{16}$

D. $2\sqrt{4}$

12. Evaluate: $\sqrt{2} \times \sqrt{8}$

A. 4
B. $\sqrt{16}$
C. $2\sqrt{4}$
D. $\sqrt{10}$

13. Simplify: $\sqrt{45} - \sqrt{20}$

A. $\sqrt{25}$
B. $\sqrt{5}$
C. $3\sqrt{5} - 2\sqrt{5}$
D. $5\sqrt{5}$

14. Rationalize: $\dfrac{8}{\sqrt{2}}$

A. $4\sqrt{2}$
B. $8\sqrt{2}$
C. $2\sqrt{8}$
D. $16\sqrt{2}$

15. Simplify: $2\sqrt{27} + \sqrt{12}$

A. $8\sqrt{3}$
B. $6\sqrt{3} + 2\sqrt{3}$
C. $7\sqrt{3}$
D. $9\sqrt{3}$

16. Express $\sqrt{72}$ in simplest surd form

A. $6\sqrt{2}$
B. $8\sqrt{3}$
C. $9\sqrt{2}$
D. $12\sqrt{6}$

17. Multiply and simplify: $\sqrt{6} \times \sqrt{24}$

A. 12
B. $\sqrt{144}$
C. $6\sqrt{4}$
D. $2\sqrt{36}$

18. Rationalize the denominator: $\dfrac{15}{\sqrt{3}}$

A. $5\sqrt{3}$
B. $3\sqrt{5}$
C. $15\sqrt{3}$
D. $\sqrt{75}$

19. Simplify: $\sqrt{98} + \sqrt{32}$

A. $11\sqrt{2}$
B. $7\sqrt{2} + 4\sqrt{2}$
C. $\sqrt{130}$
D. $9\sqrt{2}$

20. Evaluate: $\dfrac{\sqrt{50}}{\sqrt{2}}$

A. 5
B. 25
C. $\sqrt{25}$
D. 10

21. Simplify: $4\sqrt{5} - 2\sqrt{5}$

A. $2\sqrt{5}$
B. $6\sqrt{5}$
C. $2\sqrt{0}$
D. $8\sqrt{5}$

22. Expand and simplify: $(\sqrt{3} + 2)(\sqrt{3} - 2)$

A. -1
B. 1
C. $3 - 4$
D. 7

23. Rationalize: $\dfrac{12}{\sqrt{6}}$

A. $2\sqrt{6}$
B. $6\sqrt{2}$
C. $\sqrt{24}$
D. $12\sqrt{6}$

24. Simplify: $\sqrt{180}$

A. $6\sqrt{5}$
B. $9\sqrt{2}$
C. $3\sqrt{20}$
D. $18\sqrt{10}$

25. Evaluate: $\sqrt{7} \times \sqrt{7}$

A. 7
B. 14
C. 49
D. $\sqrt{14}$

26. Simplify: $\sqrt{125} - \sqrt{45}$

A. $2\sqrt{5}$

B. $5\sqrt{5} - 3\sqrt{5}$

C. $8\sqrt{5}$

D. $\sqrt{80}$

27. Rationalize: $\dfrac{20}{\sqrt{10}}$

A. $2\sqrt{10}$

B. $10\sqrt{2}$

C. $\sqrt{200}$

D. $20\sqrt{10}$

28. Simplify: $3\sqrt{12} + 4\sqrt{3}$

A. $10\sqrt{3}$

B. $6\sqrt{3} + 4\sqrt{3}$

C. $7\sqrt{15}$

D. $12\sqrt{3}$

29. Express in simplest form: $\sqrt{162}$

A. $9\sqrt{2}$

B. $6\sqrt{3}$

C. $81\sqrt{2}$

D. $3\sqrt{18}$

30. Multiply: $\sqrt{10} \times \sqrt{40}$

A. 20

B. $\sqrt{400}$

C. $10\sqrt{4}$

D. $4\sqrt{100}$

31. Rationalize the denominator: $\dfrac{18}{\sqrt{2}}$

A. $9\sqrt{2}$

B. $2\sqrt{9}$

C. $18\sqrt{2}$

D. $\sqrt{162}$

32. Simplify: $\sqrt{300}$

A. $10\sqrt{3}$

B. $3\sqrt{100}$

C. $30\sqrt{10}$

D. $100\sqrt{3}$

33. Evaluate: $\dfrac{\sqrt{72}}{\sqrt{8}}$

A. 3

B. 9

C. $\sqrt{9}$

D. 6

34. Simplify: $5\sqrt{2} + 3\sqrt{2}$

A. $8\sqrt{2}$

B. $15\sqrt{4}$

C. $8\sqrt{4}$

D. $\sqrt{64}$

35. Expand: $(\sqrt{5} + 1)^2$

A. $6 + 2\sqrt{5}$

B. $5 + 1$

C. 26

D. 6

36. Rationalize: $\dfrac{24}{\sqrt{8}}$

A. $3\sqrt{8}$

B. $6\sqrt{2}$

C. $8\sqrt{3}$

D. $12\sqrt{2}$

37. Simplify: $\sqrt{112}$

A. $4\sqrt{7}$

B. $7\sqrt{4}$

C. $8\sqrt{14}$

D. $56\sqrt{2}$

38. Multiply and simplify: $\sqrt{5} \times \sqrt{20}$

A. 10

B. $5\sqrt{4}$

C. $\sqrt{100}$

D. 20

39. Simplify: $\sqrt{147} - \sqrt{27}$

A. $4\sqrt{3}$

B. $7\sqrt{3} - 3\sqrt{3}$

C. $\sqrt{120}$

D. $10\sqrt{3}$

40. Rationalize: $\dfrac{14}{\sqrt{7}}$

A. $2\sqrt{7}$

B. $7\sqrt{2}$

C. $\sqrt{98}$

D. $14\sqrt{7}$

41. Simplify: $2\sqrt{18} + 3\sqrt{2}$

A. $9\sqrt{2}$

B. $6\sqrt{2} + 3\sqrt{2}$

C. $5\sqrt{20}$

D. $11\sqrt{2}$

42. Express in simplest form: $\sqrt{242}$

A. $11\sqrt{2}$

B. $121\sqrt{2}$

C. $2\sqrt{121}$

D. $22\sqrt{11}$

43. Evaluate: $\dfrac{\sqrt{108}}{\sqrt{3}}$

A. 6

B. 36

C. $\sqrt{36}$

D. $3\sqrt{4}$

44. Simplify: $7\sqrt{3} - 2\sqrt{3}$

A. $5\sqrt{3}$

B. $9\sqrt{3}$

C. $5\sqrt{0}$

D. $14\sqrt{6}$

45. Expand and simplify: $(\sqrt{2} + 3)(\sqrt{2} - 3)$

A. -7

B. $2 - 9$

C. 11

D. -5

46. Rationalize: $\dfrac{30}{\sqrt{5}}$

A. $6\sqrt{5}$

B. $5\sqrt{6}$

C. $\sqrt{180}$

D. $30\sqrt{5}$

47. Simplify: $\sqrt{245}$

A. $7\sqrt{5}$

B. $5\sqrt{7}$

C. $49\sqrt{5}$

D. $\sqrt{49 \times 5}$

48. Multiply: $\sqrt{15} \times \sqrt{15}$

A. 15

B. 30

C. 225

D. $\sqrt{30}$

49. Simplify: $\sqrt{192} - \sqrt{48}$

A. $4\sqrt{3}$

B. $8\sqrt{3} - 4\sqrt{3}$

C. $\sqrt{144}$

D. $12\sqrt{3}$

50. Rationalize: $\dfrac{16}{\sqrt{4}}$

A. 8

B. $4\sqrt{4}$

C. $16\sqrt{4}$

D. 32

51. Simplify: $4\sqrt{20} + 2\sqrt{5}$

A. $10\sqrt{5}$

B. $8\sqrt{5} + 2\sqrt{5}$

C. $6\sqrt{25}$

D. $20\sqrt{5}$

52. Express in simplest form: $\sqrt{288}$

A. $12\sqrt{2}$

B. $144\sqrt{2}$

C. $2\sqrt{144}$

D. $24\sqrt{3}$

53. Evaluate: $\dfrac{\sqrt{125}}{\sqrt{5}}$

A. 5

B. 25

C. $\sqrt{25}$

D. 15

54. Simplify: $9\sqrt{7} + 4\sqrt{7}$

A. $13\sqrt{7}$

B. $36\sqrt{14}$

C. $13\sqrt{14}$

D. $\sqrt{169 \times 7}$

55. Expand: $(\sqrt{6} + 2)^2$

A. $10 + 4\sqrt{6}$

B. $6 + 4$

C. 40

D. 8

56. Rationalize: $\dfrac{21}{\sqrt{3}}$

A. $7\sqrt{3}$

B. $3\sqrt{7}$

C. $21\sqrt{3}$

D. $\sqrt{147}$

57. Simplify: $\sqrt{343}$

A. $7\sqrt{7}$

B. $49\sqrt{7}$

C. $\sqrt{49 \times 7}$

D. $343\sqrt{1}$

58. Multiply and simplify: $\sqrt{8} \times \sqrt{18}$

A. 12

B. $\sqrt{144}$

C. $2\sqrt{36}$

D. $4\sqrt{9}$

59. Simplify: $\sqrt{175} + \sqrt{63}$

A. $8\sqrt{7}$

B. $5\sqrt{7} + 3\sqrt{7}$

C. $\sqrt{238}$

D. $15\sqrt{7}$

60. Rationalize: $\dfrac{25}{\sqrt{5}}$

A. $5\sqrt{5}$

B. $25\sqrt{5}$

C. $\sqrt{125}$

D. 125

61. Simplify: $5\sqrt{32} - 2\sqrt{2}$

A. $18\sqrt{2}$

B. $20\sqrt{2} - 2\sqrt{2}$

C. $3\sqrt{30}$

D. $8\sqrt{2}$

62. Express in simplest form: $\sqrt{392}$

A. $14\sqrt{2}$

B. $196\sqrt{2}$

C. $2\sqrt{196}$

D. $28\sqrt{7}$

63. Evaluate: $\dfrac{\sqrt{200}}{\sqrt{8}}$

A. 5

B. 25

C. $\sqrt{25}$

D. 10

64. Simplify: $6\sqrt{11} - 2\sqrt{11}$

A. $4\sqrt{11}$

B. $8\sqrt{11}$

C. $4\sqrt{0}$

D. $12\sqrt{22}$

65. Expand and simplify: $(\sqrt{10} + 1)(\sqrt{10} - 1)$

A. 9

B. $10 - 1$

C. 11

D. -9

66. Rationalize: $\dfrac{35}{\sqrt{7}}$

A. $5\sqrt{7}$

B. $7\sqrt{5}$

C. $\sqrt{245}$

D. $35\sqrt{7}$

67. Simplify: $\sqrt{450}$

A. $15\sqrt{2}$

B. $225\sqrt{2}$

C. $2\sqrt{225}$

D. $9\sqrt{50}$

68. Multiply: $\sqrt{6} \times \sqrt{54}$

A. 18

B. $\sqrt{324}$

C. $6\sqrt{9}$

D. $3\sqrt{36}$

69. Simplify: $\sqrt{243} - \sqrt{48}$

A. $5\sqrt{3}$

B. $9\sqrt{3} - 4\sqrt{3}$

C. $\sqrt{195}$

D. $13\sqrt{3}$

70. Rationalize: $\dfrac{40}{\sqrt{10}}$

A. $4\sqrt{10}$
B. $10\sqrt{4}$
C. $\sqrt{160}$
D. $40\sqrt{10}$

71. Simplify: $3\sqrt{50} + 4\sqrt{2}$

A. $19\sqrt{2}$
B. $15\sqrt{2} + 4\sqrt{2}$
C. $7\sqrt{52}$
D. $12\sqrt{100}$

72. Express in simplest form: $\sqrt{500}$

A. $10\sqrt{5}$
B. $250\sqrt{2}$
C. $5\sqrt{100}$
D. $100\sqrt{5}$

73. Evaluate: $\dfrac{\sqrt{180}}{\sqrt{5}}$

A. 6
B. 36
C. $\sqrt{36}$
D. $3\sqrt{4}$

74. Simplify: $10\sqrt{3} + 5\sqrt{3}$

A. $15\sqrt{3}$
B. $50\sqrt{9}$
C. $15\sqrt{6}$
D. $\sqrt{675}$

75. Expand: $(\sqrt{11} + 3)^2$

A. $20 + 6\sqrt{11}$
B. $11 + 9$
C. 121
D. 14

76. Rationalize: $\dfrac{42}{\sqrt{6}}$

A. $7\sqrt{6}$
B. $6\sqrt{7}$
C. $42\sqrt{6}$
D. $\sqrt{252}$

77. Simplify: $\sqrt{512}$

A. $16\sqrt{2}$
B. $256\sqrt{2}$
C. $2\sqrt{256}$
D. $8\sqrt{64}$

78. Multiply and simplify: $\sqrt{12} \times \sqrt{27}$

A. 18
B. $\sqrt{324}$
C. $6\sqrt{9}$
D. $3\sqrt{36}$

79. Simplify: $\sqrt{320} + \sqrt{80}$

A. $12\sqrt{5}$
B. $8\sqrt{5} + 4\sqrt{5}$
C. $\sqrt{400}$
D. $20\sqrt{5}$

80. Rationalize: $\dfrac{48}{\sqrt{12}}$

A. $4\sqrt{12}$
B. $12\sqrt{4}$
C. $4\sqrt{3}$
D. $8\sqrt{3}$

81. Simplify: $6\sqrt{45} - 3\sqrt{5}$

A. $15\sqrt{5}$
B. $18\sqrt{5} - 3\sqrt{5}$
C. $3\sqrt{40}$
D. $21\sqrt{5}$

82. Express in simplest form: $\sqrt{578}$

A. $17\sqrt{2}$
B. $289\sqrt{2}$
C. $2\sqrt{289}$
D. $34\sqrt{17}$

83. Evaluate: $\dfrac{\sqrt{243}}{\sqrt{3}}$

A. 9
B. 81
C. $\sqrt{81}$
D. 27

84. Simplify: $8\sqrt{13} + 7\sqrt{13}$

A. $15\sqrt{13}$

B. $56\sqrt{26}$

C. $15\sqrt{26}$

D. $\sqrt{3575}$

85. Expand and simplify: $(\sqrt{7}+4)(\sqrt{7}-4)$

A. -9

B. $7-16$

C. 23

D. -7

86. Rationalize: $\dfrac{56}{\sqrt{8}}$

A. $7\sqrt{8}$

B. $14\sqrt{2}$

C. $8\sqrt{7}$

D. $28\sqrt{2}$

87. Simplify: $\sqrt{605}$

A. $11\sqrt{5}$

B. $121\sqrt{5}$

C. $5\sqrt{121}$

D. $\sqrt{121\times 5}$

88. Multiply: $\sqrt{11}\times\sqrt{44}$

A. 22

B. $\sqrt{484}$

C. $11\sqrt{4}$

D. $2\sqrt{121}$

89. Simplify: $\sqrt{363}-\sqrt{27}$

A. $8\sqrt{3}$

B. $11\sqrt{3}-3\sqrt{3}$

C. $\sqrt{336}$

D. $14\sqrt{3}$

90. Rationalize: $\dfrac{4}{\sqrt{3}+1}$

A. $2\sqrt{3}-2$

B. $2(\sqrt{3}-1)$

C. $4\sqrt{3}-4$

D. $\sqrt{3}-1$

91. Simplify: $\dfrac{1}{\sqrt{5}-2}$

A. $\sqrt{5}+2$

B. $\dfrac{\sqrt{5}+2}{5}$

C. $5+2$

D. $\sqrt{5}-2$

92. Evaluate: $(\sqrt{8}+\sqrt{2})(\sqrt{8}-\sqrt{2})$

A. 6

B. $8-2$

C. 10

D. 4

93. Rationalize: $\dfrac{6}{\sqrt{7}-\sqrt{3}}$

A. $\dfrac{3(\sqrt{7}+\sqrt{3})}{2}$

B. $\sqrt{7}+\sqrt{3}$

C. $3\sqrt{7}+3\sqrt{3}$

D. $6(\sqrt{7}+\sqrt{3})$

94. Simplify: $\sqrt{12}+\sqrt{27}-\sqrt{75}$

A. 0

B. $-2\sqrt{3}$

C. $2\sqrt{3}$

D. $\sqrt{3}$

95. Evaluate: $\dfrac{\sqrt{98}-\sqrt{32}}{\sqrt{2}}$

A. 3

B. $7-4$

C. 11

D. $\sqrt{33}$

96. Rationalize: $\dfrac{10}{\sqrt{6}+\sqrt{2}}$

A. $\dfrac{5(\sqrt{6}-\sqrt{2})}{2}$

B. $5\sqrt{6}-5\sqrt{2}$

C. $\sqrt{6}-\sqrt{2}$

D. $10(\sqrt{6}-\sqrt{2})$

97. Simplify: $(\sqrt{5}+\sqrt{3})^2$

A. $8+2\sqrt{15}$

B. $5+3$

C. 64

D. $8+\sqrt{15}$

98. Evaluate: $\dfrac{\sqrt{72}+\sqrt{50}}{\sqrt{2}}$

    A. 11
    B. $6+5$
    C. $\sqrt{61}$
    D. 8

99. Rationalize: $\dfrac{8}{\sqrt{5}+\sqrt{3}}$

    A. $4(\sqrt{5}-\sqrt{3})$
    B. $8\sqrt{5}-8\sqrt{3}$
    C. $\sqrt{5}-\sqrt{3}$
    D. $2(\sqrt{5}-\sqrt{3})$

100. Simplify and rationalize the expression $\dfrac{2}{\sqrt{3}-\sqrt{2}}$.

    A. $\sqrt{3}-\sqrt{2}$
    B. $2\sqrt{3}-2\sqrt{2}$
    C. $2\sqrt{3}+2\sqrt{2}$
    D. $\sqrt{3}+\sqrt{2}$

2.4 Logarithms

2.4.1 Questions

1. Evaluate: $\log_2 8$.

    A. 2
    B. 3
    C. 4
    D. 8

2. If $\log_{10} 2 = 0.3010$, find $\log_{10} 20$.

    A. 0.6020
    B. 1.3010
    C. 2.3010
    D. 6.020

3. Simplify: $\log_5 125$.

    A. 1
    B. 2
    C. 3
    D. 5

4. If $\log_x 81 = 4$, find x.

    A. 3
    B. 4
    C. 9
    D. 27

5. Evaluate: $\log_3 1$.

    A. 0
    B. 1
    C. 3
    D. undefined

6. Simplify: $\log_7 49 + \log_7 7$.

    A. 1
    B. 2
    C. 3
    D. 4

7. If $\log_{10} 5 = 0.6990$, find $\log_{10} 50$.

    A. 0.3010
    B. 1.3010
    C. 1.6990
    D. 3.4950

8. Evaluate: $\log_4 64$.

    A. 2
    B. 3
    C. 4
    D. 16

9. Simplify: $\log_2 32 - \log_2 4$.

    A. 2
    B. 3
    C. 4
    D. 8

10. If $\log_5 x = 3$, find x.

    A. 8
    B. 15
    C. 25
    D. 125

11. Evaluate: $2\log_3 9$.

A. 2
B. 3
C. 4
D. 6

12. Simplify: $\log_6 36 + \log_6 1$.

A. 0
B. 1
C. 2
D. 3

13. If $\log_{10} 3 = 0.4771$, find $\log_{10} 30$.

A. 0.9542
B. 1.4771
C. 4.771
D. 14.313

14. Evaluate: $\log_8 512$.

A. 2
B. 3
C. 4
D. 64

15. Simplify: $\log_5 25 \times \log_5 5$.

A. 1
B. 2
C. 3
D. 5

16. If $\log_2 x = 5$, find x.

A. 10
B. 25
C. 32
D. 64

17. Evaluate: $\log_{10} 100$.

A. 1
B. 2
C. 10
D. 100

18. Simplify: $\log_3 81 - \log_3 9$.

A. 1
B. 2
C. 3
D. 4

19. If $\log_{10} 2 = 0.3010$, find $\log_{10} 8$.

A. 0.6020
B. 0.9030
C. 2.408
D. 8.030

20. Evaluate: $\log_9 729$.

A. 2
B. 3
C. 4
D. 81

21. Simplify: $3 \log_2 4$.

A. 2
B. 4
C. 6
D. 8

22. If $\log_x 16 = 2$, find x.

A. 2
B. 4
C. 8
D. 32

23. Evaluate: $\log_5 1$.

A. 0
B. 1
C. 5
D. undefined

24. Simplify: $\log_4 16 + \log_4 4$.

A. 2
B. 3
C. 4
D. 5

25. If $\log_{10} 7 = 0.8451$, find $\log_{10} 70$.

A. 1.6902
B. 1.8451
C. 8.451
D. 59.157

26. Evaluate: $\log_6 216$.

A. 2

B. 3

C. 4

D. 36

27. Simplify: $\log_7 343 - \log_7 49$.

A. 0

B. 1

C. 2

D. 7

28. If $\log_3 x = 4$, find x.

A. 12

B. 27

C. 64

D. 81

29. Evaluate: $\log_{10} 1000$.

A. 2

B. 3

C. 10

D. 100

30. Simplify: $2\log_5 5 + \log_5 25$.

A. 2

B. 3

C. 4

D. 5

31. If $\log_x 27 = 3$, find x.

A. 3

B. 9

C. 27

D. 81

32. Evaluate: $\log_2 \frac{1}{8}$.

A. -3

B. -2

C. $\frac{1}{3}$

D. 3

33. Simplify: $\log_3 27 + \log_3 3$.

A. 2

B. 3

C. 4

D. 9

34. If $\log_{10} 4 = 0.6021$, find $\log_{10} 400$.

A. 1.2042

B. 1.6021

C. 2.6021

D. 240.84

35. Evaluate: $\log_5 \frac{1}{25}$.

A. -2

B. -1

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

D. 2

36. Simplify: $\log_8 64 - \log_8 8$.

A. 0

B. 1

C. 2

D. 8

37. If $\log_4 x = 3$, find x.

A. 12

B. 16

C. 64

D. 81

38. Evaluate: $3\log_3 3$.

A. 1

B. 3

C. 9

D. 27

39. Simplify: $\log_2 16 + \log_2 2$.

A. 3

B. 4

C. 5

D. 32

40. If $\log_{10} 6 = 0.7782$, find $\log_{10} 60$.

A. 1.5564

B. 1.7782

C. 7.782

D. 46.692

41. Evaluate: $\log_{10} \frac{1}{100}$.

A. -2

B. -1

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

D. 2

42. Simplify: $\log_9 81 + \log_9 9$.

A. 2

B. 3

C. 4

D. 9

43. If $\log_7 x = 2$, find x.

A. 14

B. 49

C. 98

D. 343

44. Evaluate: $\log_3 \frac{1}{27}$.

A. -3

B. -2

C. $\frac{1}{3}$

D. 3

45. Simplify: $2 \log_4 4 + \log_4 16$.

A. 2

B. 3

C. 4

D. 6

46. If $\log_{10} 8 = 0.9031$, find $\log_{10} 800$.

A. 1.8062

B. 2.9031

C. 9.031

D. 722.48

47. Evaluate: $\log_6 \frac{1}{36}$.

A. -2

B. -1

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

D. 2

48. Simplify: $\log_{10} 1000 - \log_{10} 10$.

A. 1

B. 2

C. 3

D. 100

49. If $\log_2 x = 6$, find x.

A. 8

B. 12

C. 32

D. 64

50. Evaluate: $4 \log_2 2$.

A. 2

B. 4

C. 8

D. 16

51. Simplify: $\log_5 125 + \log_5 5$.

A. 2

B. 3

C. 4

D. 5

52. If $\log_x 125 = 3$, find x.

A. 5

B. 25

C. 125

D. 625

53. Evaluate: $\log_4 \frac{1}{16}$.

A. -2

B. -1

C. $\frac{1}{4}$

D. 4

54. Simplify: $\log_7 49 + \log_7 7$.

A. 2

B. 3

C. 4

D. 7

55. If $\log_{10} 9 = 0.9542$, find $\log_{10} 900$.

A. 1.9084
B. 2.9542
C. 9.542
D. 858.78

56. Evaluate: $\log_8 \frac{1}{64}$.

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

57. Simplify: $\log_3 243 - \log_3 27$.

A. 1
B. 2
C. 3
D. 9

58. If $\log_6 x = 3$, find x.

A. 18
B. 36
C. 216
D. 1296

59. Evaluate: $\log_{10} \frac{1}{1000}$.

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

60. Simplify: $3 \log_5 5 + \log_5 1$.

A. 1
B. 2
C. 3
D. 5

61. If $\log_x 64 = 3$, find x.

A. 2
B. 4
C. 8
D. 16

62. Evaluate: $\log_9 \frac{1}{81}$.

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

63. Simplify: $\log_2 64 + \log_2 4$.

A. 6
B. 8
C. 10
D. 256

64. If $\log_8 x = 2$, find x.

A. 16
B. 64
C. 128
D. 512

65. Evaluate: $5 \log_3 3$.

A. 3
B. 5
C. 15
D. 243

66. Simplify: $\log_6 216 - \log_6 36$.

A. 0
B. 1
C. 2
D. 6

67. If $\log_{10} x = 2$, find x.

A. 2
B. 10
C. 20
D. 100

68. Evaluate: $\log_7 \frac{1}{343}$.

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

69. Simplify: $2 \log_6 6 + \log_6 36$.

A. 2
B. 3

C. 4

D. 6

70. If $\log_5 x = 4$, find x.

A. 20

B. 125

C. 625

D. 3125

71. Evaluate: $\log_{10} \sqrt{10}$.

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

B. 1

C. 2

D. 5

72. Simplify: $\log_4 256 - \log_4 16$.

A. 1

B. 2

C. 3

D. 4

73. If $\log_x 32 = 5$, find x.

A. 2

B. 4

C. 8

D. 16

74. Evaluate: $\log_5 \frac{1}{125}$.

A. -3

B. -2

C. $\frac{1}{3}$

D. 3

75. Simplify: $\log_8 512 + \log_8 8$.

A. 3

B. 4

C. 5

D. 8

76. If $\log_9 x = 2$, find x.

A. 18

B. 81

C. 162

D. 729

77. Evaluate: $\log_{10} \sqrt[3]{10}$.

A. $\frac{1}{3}$

B. 1

C. 3

D. 10

78. Simplify: $3 \log_2 2 + 2 \log_2 4$.

A. 5

B. 6

C. 7

D. 8

79. If $\log_3 x = 5$, find x.

A. 15

B. 81

C. 243

D. 729

80. Evaluate: $\log_{10} 0.01$.

A. -2

B. -1

C. 0.01

D. 2

81. Simplify: $\log_5 625 - \log_5 25$.

A. 1

B. 2

C. 3

D. 5

82. If $\log_x 1000 = 3$, find x.

A. 10

B. 100

C. 333

D. 1000

83. Evaluate: $\log_{10} \sqrt[4]{10}$.

A. $\frac{1}{4}$

B. 1

C. 2.5

D. 4

84. Simplify: $\log_7 2401 - \log_7 343$.

A. 0
B. 1
C. 2
D. 7

85. If $\log_4 x = 4$, find x.

A. 16
B. 64
C. 128
D. 256

86. Evaluate: $\log_{10} 0.001$.

A. -3
B. -2
C. 0.001
D. 3

87. Simplify: $2\log_3 9 + \log_3 3$.

A. 3
B. 4
C. 5
D. 9

88. If $\log_{10} x = -1$, find x.

A. 0.01
B. 0.1
C. 1
D. 10

89. Evaluate: $\log_2 \sqrt{8}$.

A. $\frac{3}{2}$
B. 2
C. 3
D. 4

90. Simplify: $\log_9 729 + \log_9 9$.

A. 3
B. 4
C. 5
D. 9

91. If $\log_7 x = 3$, find x.

A. 21
B. 49
C. 147
D. 343

92. Evaluate: $\log_{10} 0.0001$.

A. -4
B. -3
C. 0.0001
D. 4

93. Simplify: $3\log_4 4 + \log_4 64$.

A. 4
B. 5
C. 6
D. 8

94. If $\log_{10} x = -2$, find x.

A. 0.001
B. 0.01
C. 0.1
D. 1

95. Evaluate: $\log_3 \sqrt{27}$.

A. $\frac{3}{2}$
B. 2
C. 3
D. 9

96. Simplify: $\log_{10} 10000 - \log_{10} 100$.

A. 1
B. 2
C. 3
D. 100

97. If $\log_2 x = 7$, find x.

A. 14
B. 64
C. 128
D. 256

98. Evaluate: $\log_{10} \sqrt{100}$.

A. $\frac{1}{2}$
B. 1
C. 2
D. 10

99. Simplify: $\log_6 1296 - \log_6 216$.

A. 0

B. 1

C. 2

D. 6

100. If $\log_{10} 2 = 0.3010$ and $\log_{10} 3 = 0.4771$, evaluate $\log_{10} 18$.

A. 1.2552

B. 1.2551

C. 1.7781

D. 1.7782

Chapter 3

Geometry

3.1 Circle Geometry

3.1.1 Questions

1. A chord of length 24 cm is drawn in a circle of radius 13 cm. Calculate the distance of the chord from the center.

   A. 5 cm

   B. 7 cm

   C. 9 cm

   D. 11 cm

2. Two chords AB and CD intersect at point E inside a circle. If $AE = 4$ cm, $EB = 6$ cm and $CE = 3$ cm, find ED.

   A. 6 cm

   B. 8 cm

   C. 10 cm

   D. 12 cm

3. A tangent from an external point P to a circle with center O and radius 5 cm has length 12 cm. Find the distance OP.

   A. 7 cm

   B. 11 cm

   C. 13 cm

   D. 17 cm

4. In a circle, a chord subtends an angle of 60° at the center. If the radius is 10 cm, find the length of the chord.

   A. 5 cm

   B. 8 cm

   C. 10 cm

   D. 12 cm

5. An arc of a circle subtends an angle of 120° at the center. If the radius is 7 cm, what angle does it subtend at the circumference?

   A. 30°

   B. 45°

   C. 60°

   D. 90°

6. Two tangents from an external point to a circle are 8 cm each. If the angle between them is 60°, find the radius of the circle.

   A. 4 cm

   B. $4\sqrt{3}$ cm

   C. 8 cm

   D. $8\sqrt{3}$ cm

7. In a cyclic quadrilateral $ABCD$, $\angle A = 70^\circ$ and $\angle C = 110^\circ$. Find $\angle B$.

   A. 70°

   B. 90°

   C. 110°

   D. 180°

8. A chord of a circle is 16 cm long and is 6 cm from the center. Calculate the radius of the circle.

   A. 8 cm

   B. 10 cm

   C. 12 cm

   D. 14 cm

9. Two circles with radii 4 cm and 6 cm touch externally. Calculate the distance between their centers.

   A. 2 cm

   B. 5 cm

   C. 10 cm

   D. 12 cm

10. A chord of length 20 cm subtends an angle of 90° at the center of a circle. Find the radius.

    A. 10 cm

    B. $10\sqrt{2}$ cm

    C. 15 cm

    D. 20 cm

11. In a circle with center O, a chord AB is 12 cm long. If the perpendicular from O to AB is 8 cm, find the radius.

    A. 9 cm

    B. 10 cm

    C. 11 cm

    D. 12 cm

12. Two tangents are drawn from point P to a circle with center O. If the angle between the tangents is 80°, find $\angle POQ$ where Q is one point of tangency.

    A. 40°

    B. 50°

    C. 80°

    D. 100°

13. A cyclic quadrilateral has angles x, $2x$, $3x$, and $4x$. Find the largest angle.

    A. 72°

    B. 108°

    C. 120°

    D. 144°

14. In a circle, an inscribed angle is 40°. Find the central angle subtending the same arc.

    A. 20°

    B. 40°

    C. 60°

    D. 80°

15. Two chords PQ and RS of a circle intersect at T outside the circle. If $PT = 6$ cm, $TQ = 4$ cm and $RT = 8$ cm, find TS.

    A. 2 cm

    B. 3 cm

    C. 4 cm

    D. 5 cm

16. A tangent to a circle makes an angle of 30° with a chord drawn from the point of contact. Find the angle subtended by the chord at the center.

    A. 60°

    B. 90°

    C. 120°

    D. 150°

17. In a circle of radius 15 cm, a chord is 18 cm long. Calculate its distance from the center.

    A. 6 cm

    B. 9 cm

    C. 12 cm

    D. 15 cm

18. Two circles with radii 8 cm and 3 cm touch internally. Find the distance between their centers.

    A. 3 cm

    B. 5 cm

    C. 8 cm

    D. 11 cm

19. A chord of a circle subtends an angle of 144° at the center. What angle does it subtend at a point on the minor arc?

    A. 36°

    B. 72°

    C. 108°

    D. 144°

20. In a cyclic quadrilateral $PQRS$, $\angle P = 85°$. Find $\angle R$.

    A. 85°

    B. 95°

    C. 105°

    D. 175°

21. A tangent and a chord meet at a point on a circle, making an angle of 50°. Find the angle in the alternate segment.

    A. 25°

    B. 40°

    C. 50°

D. 100°

22. Two parallel chords in a circle have lengths 16 cm and 12 cm. If the radius is 10 cm, find the distance between the chords (both on the same side of center).

A. 2 cm

B. 4 cm

C. 6 cm

D. 8 cm

23. A circle passes through the vertices of a square with side 8 cm. Find the radius of the circle.

A. 4 cm

B. $4\sqrt{2}$ cm

C. 8 cm

D. $8\sqrt{2}$ cm

24. In a circle, a chord $AB = 14$ cm and its perpendicular distance from center O is $7\sqrt{3}$ cm. Find the radius.

A. 12 cm

B. 14 cm

C. 16 cm

D. 18 cm

25. Two secants are drawn from point P to a circle. If the external parts are 4 cm and 5 cm and one whole secant is 12 cm, find the other whole secant.

A. 9 cm

B. 9.6 cm

C. 10 cm

D. 11 cm

26. A cyclic trapezium has parallel sides of lengths 10 cm and 6 cm. If the radius is 5 cm, find the length of one of the non-parallel sides.

A. 4 cm

B. 5 cm

C. 6 cm

D. 8 cm

27. In a circle with radius r, two parallel chords are on opposite sides of the center. If their lengths are 16 cm and 12 cm and $r = 10$ cm, find the distance between them.

A. 10 cm

B. 12 cm

C. 14 cm

D. 16 cm

28. A chord subtends an angle of 120° at the center of a circle with radius 6 cm. Find the area of the minor segment.

A. $(12\pi - 9\sqrt{3})$ cm^2

B. $(9\pi - 9\sqrt{3})$ cm^2

C. $(6\pi - 9\sqrt{3})$ cm^2

D. $(12\pi - 18\sqrt{3})$ cm^2

29. From an external point, two tangents are drawn to a circle of radius 5 cm. If each tangent is 12 cm long, find the distance between the points of tangency.

A. 8.46 cm

B. 9.23 cm

C. 10 cm

D. 12 cm

30. In a circle, an angle in a semicircle is:

A. 45°

B. 60°

C. 90°

D. 180°

31. A chord of length 8 cm is at distance 3 cm from center. Another chord is at distance 4 cm. Find its length.

A. 4 cm

B. 6 cm

C. $2\sqrt{9}$ cm

D. $2\sqrt{9}$ cm

32. Two circles of equal radii 5 cm each intersect such that each passes through the center of the other. Find the length of the common chord.

A. 5 cm

B. $5\sqrt{2}$ cm

C. $5\sqrt{3}$ cm

D. 10 cm

33. In a cyclic quadrilateral, two opposite angles are $(3x + 10)^\circ$ and $(2x + 20)^\circ$. Find x.

A. 30°

B. 35°

C. 40°

D. 45°

34. A tangent to a circle of radius 7 cm from point P is 24 cm long. Find OP.

A. 17 cm

B. 20 cm

C. 25 cm

D. 31 cm

35. In a circle, a chord $AB = 10$ cm subtends an angle of 60° at the center. Find the radius.

A. 5 cm

B. 8 cm

C. 10 cm

D. 12 cm

36. Two chords AB and CD of a circle intersect at right angles at point E inside the circle. If $AE = 3$ cm, $EB = 4$ cm and $CE = 2$ cm, find ED.

A. 5 cm

B. 6 cm

C. 7 cm

D. 8 cm

37. A circle has diameter 26 cm. A chord parallel to the diameter is 24 cm long. Find its distance from the diameter.

A. 3 cm

B. 4 cm

C. 5 cm

D. 6 cm

38. In a cyclic quadrilateral $ABCD$, $\angle DAB = 65^\circ$ and $\angle ABC = 75^\circ$. Find $\angle BCD$.

A. 105°

B. 115°

C. 125°

D. 140°

39. The angle between a tangent and a chord drawn from the point of contact is 35°. Find the angle subtended by the chord at the center.

A. 35°

B. 55°

C. 70°

D. 110°

40. A chord of a circle is equal to its radius. Find the angle subtended by the chord at the center.

A. 30°

B. 45°

C. 60°

D. 90°

41. Two tangents from external point T touch a circle at A and B. If $\angle ATB = 50^\circ$ and radius is 6 cm, find TA.

A. $6\tan 25^\circ$ cm

B. $6/\tan 25^\circ$ cm

C. $6\sin 25^\circ$ cm

D. $6/\sin 25^\circ$ cm

42. In a circle with center O and radius 10 cm, two chords AB and CD are each 12 cm long. Find the distance between them if they are on the same side.

A. 0 cm

B. 8 cm

C. 12 cm

D. 16 cm

43. A cyclic quadrilateral has three angles 80°, 95°, and 105°. Find the fourth angle.

A. 70°

B. 75°

C. 80°

D. 85°

44. Two circles with radii 9 cm and 4 cm intersect. The distance between their centers is 10 cm. Find the length of the common chord.

A. 6 cm

B. 7.2 cm

C. 8 cm

D. 9.6 cm

45. A secant and a tangent are drawn from external point P to a circle. If the tangent is 8 cm and the external part of the secant is 4 cm, find the whole secant.

A. 12 cm

B. 16 cm

C. 18 cm

D. 20 cm

46. In a circle, a chord PQ is 16 cm long and subtends angle 90° at center O. Find the area of triangle POQ.

A. 32 cm^2

B. 48 cm^2

C. 64 cm^2

D. 72 cm^2

47. Two parallel chords of lengths 6 cm and 8 cm are on opposite sides of center in a circle of radius 5 cm. Find distance between them.

    A. 6 cm

    B. 7 cm

    C. 8 cm

    D. 9 cm

48. The angle in the alternate segment equals the angle between:

    A. Two chords

    B. Two radii

    C. A tangent and a chord

    D. Two tangents

49. In a circle of radius 13 cm, a chord $AB = 24$ cm. Find the angle subtended by the chord at center.

    A. 67.4°

    B. 112.6°

    C. 134.8°

    D. 157.4°

50. A circle is inscribed in an equilateral triangle of side 12 cm. Find the radius of the circle.

    A. $2\sqrt{3}$ cm

    B. $3\sqrt{3}$ cm

    C. $4\sqrt{3}$ cm

    D. $6\sqrt{3}$ cm

51. Two chords intersect inside a circle at point M. If the segments of one chord are 5 cm and 7 cm, and one segment of other is 10 cm, find the other segment.

    A. 3.5 cm

    B. 4 cm

    C. 4.5 cm

    D. 5 cm

52. In a cyclic quadrilateral, if one angle is three times another and their sum is 180°, find the smaller angle.

    A. 30°

    B. 45°

    C. 60°

    D. 90°

53. A tangent of length 15 cm is drawn from point P to circle with radius 8 cm. Find the angle between the tangent and the line joining P to the center.

    A. 28.1°

    B. 32.0°

    C. 58.0°

    D. 62.0°

54. In a circle, a diameter $AB = 20$ cm. A chord CD perpendicular to AB at point E where $AE = 4$ cm. Find CD.

    A. 12 cm

    B. 14 cm

    C. 16 cm

    D. 18 cm

55. Two circles touch externally. The sum of their radii is 15 cm and distance between centers is 15 cm. If one radius is 9 cm, find the other.

    A. 4 cm

    B. 5 cm

    C. 6 cm

    D. 7 cm

56. A chord subtends angle θ at center and angle α at circumference. The relationship is:

    A. $\theta = \alpha$

    B. $\theta = 2\alpha$

    C. $\alpha = 2\theta$

    D. $\theta + \alpha = 180^\circ$

57. In a circle with radius r, a chord of length $r\sqrt{3}$ is drawn. Find the angle it subtends at center.

    A. 60°

    B. 90°

    C. 120°

    D. 150°

58. Two tangents from point P make angle 60° with each other. If radius is 5 cm, find OP.

    A. 5 cm

    B. 10 cm

    C. $5\sqrt{3}$ cm

    D. $10\sqrt{3}$ cm

59. A cyclic quadrilateral has consecutive angles in ratio $2 : 3 : 4 : x$. Find x.

    A. 3

    B. 4

    C. 5

D. 6

60. In circle with center O, chord $AB = 8$ cm and $\angle AOB = 90°$. Find radius.

A. 4 cm

B. $4\sqrt{2}$ cm

C. 6 cm

D. 8 cm

61. Two circles of radii 7 cm and 5 cm touch internally. Their common tangent divides the line joining centers in ratio:

A. 5 : 7

B. 7 : 5

C. 2 : 5

D. 5 : 2

62. A chord is 12 cm from center of circle with radius 13 cm. Find its length.

A. 5 cm

B. 8 cm

C. 10 cm

D. 12 cm

63. In a cyclic trapezium $ABCD$ with $AB \parallel CD$, if $\angle A = 70°$, find $\angle C$.

A. 70°

B. 90°

C. 110°

D. 140°

64. From external point, secant and tangent are drawn. If tangent is 12 cm and internal part of secant is 9 cm, find external part.

A. 6 cm

B. 7 cm

C. 8 cm

D. 9 cm

65. A regular hexagon is inscribed in circle of radius 8 cm. Find side of hexagon.

A. 4 cm

B. 6 cm

C. 8 cm

D. 10 cm

66. Angle between tangent and radius at point of contact is:

A. 0°

B. 45°

C. 60°

D. 90°

67. Two chords $AB = 10$ cm and $CD = 24$ cm are in circle of radius 13 cm. Find sum of their distances from center.

A. 10 cm

B. 12 cm

C. 17 cm

D. 20 cm

68. In cyclic quadrilateral, diagonal divides it into two triangles. If angles of one triangle are 40°, 60°, 80°, find angle opposite to 80° in other triangle.

A. 40°

B. 60°

C. 80°

D. 100°

69. A circle passes through vertices of rectangle with sides 6 cm and 8 cm. Find diameter.

A. 7 cm

B. 10 cm

C. 12 cm

D. 14 cm

70. Chord AB of circle with center O and radius 5 cm has length 8 cm. Point M is midpoint of AB. Find OM.

A. 2 cm

B. 3 cm

C. 4 cm

D. 5 cm

71. Two tangents from external point are 6 cm and 8 cm long. This is:

A. Possible

B. Impossible

C. Possible only if radii differ

D. None of these

72. A chord subtends 45° at center. Angle at major arc is:

A. 22.5°

B. 45°

C. 67.5°

D. 90°

73. In circle, perpendicular from center to chord bisects:

A. The chord

B. The arc

C. The angle at center

D. All of these

74. Tangents from external point to circle are:

A. Unequal

B. Equal

C. Parallel

D. Perpendicular

75. A cyclic quadrilateral with all sides equal is a:

A. Rectangle

B. Rhombus

C. Square

D. Trapezium

76. In circle of radius 10 cm, chord at 6 cm from center has length:

A. 8 cm

B. 12 cm

C. 14 cm

D. 16 cm

77. Two circles touch externally. Line through point of contact passes through:

A. One center only

B. Both centers

C. Neither center

D. Midpoint of line joining centers

78. Angle subtended by diameter at circumference is:

A. 45°

B. 60°

C. 90°

D. 180°

79. Common chord of two intersecting circles is:

A. Parallel to line joining centers

B. Perpendicular to line joining centers

C. Equal to sum of radii

D. Equal to difference of radii

80. In cyclic quadrilateral, product of diagonals equals:

A. Sum of products of opposite sides

B. Difference of products of opposite sides

C. Product of adjacent sides

D. Twice the area

81. A chord of length $2r$ in circle of radius r is:

A. Impossible

B. The diameter

C. Any chord

D. The radius

82. Maximum number of common tangents to two circles touching externally is:

A. 1

B. 2

C. 3

D. 4

83. In circle, equal chords are:

A. Equidistant from center

B. At different distances from center

C. Parallel

D. Perpendicular

84. Angle in semicircle is always:

A. Acute

B. Right

C. Obtuse

D. Reflex

85. Two chords AB and CD intersect at E. $AE \times EB$ equals:

A. $CE + ED$

B. $CE - ED$

C. $CE \times ED$

D. CE/ED

86. Radius of circle inscribed in right triangle with legs 3 cm and 4 cm is:

A. 1 cm

B. 1.5 cm

C. 2 cm

D. 2.5 cm

87. Circle circumscribing square of side a has radius:

A. $a/2$

B. $a/\sqrt{2}$

C. $a\sqrt{2}/2$

D. $a\sqrt{2}$

88. Tangent to circle is perpendicular to:

A. Chord

B. Diameter

C. Radius at point of contact

D. Another tangent

89. In circle of radius 13 cm, two parallel chords of lengths 10 cm and 24 cm are on same side. Distance between them is:

A. 7 cm

B. 10 cm

C. 12 cm

D. 17 cm

90. Angle between two tangents from external point is 60°. Angle between radii to points of tangency is:

A. 60°

B. 90°

C. 120°

D. 150°

91. A chord divides circle into two parts. Angle subtended by smaller arc at center is 100°. Angle at circumference on larger arc is:

A. 50°

B. 80°

C. 100°

D. 130°

92. Locus of centers of circles passing through two fixed points is:

A. Circle

B. Perpendicular bisector of line joining points

C. Line joining points

D. Parallel line

93. Circle inscribed in equilateral triangle of side a has radius:

A. $a/2\sqrt{3}$

B. $a/\sqrt{3}$

C. $a\sqrt{3}/6$

D. $a\sqrt{3}/3$

94. Two chords intersect inside circle. One is divided into segments 3 cm and 8 cm. Other is 12 cm. One segment of second chord is:

A. 2 cm

B. 4 cm

C. 6 cm

D. 8 cm

95. Cyclic quadrilateral with two adjacent right angles is a:

A. Square

B. Rectangle

C. Trapezium

D. Impossible

96. Maximum distance between two points on circle of radius r is:

A. r

B. $r\sqrt{2}$

C. $2r$

D. πr

97. In circle, angle between tangent and chord equals angle in:

A. Semicircle

B. Alternate segment

C. Same segment

D. Minor segment

98. Number of tangents from external point to circle:

A. 0

B. 1

C. 2

D. Infinite

99. Circle touching all sides of triangle is called:

A. Circumcircle

B. Incircle

C. Excircle

D. Concentric circle

100. The angle formed by a diameter at any point on the circumference is:

A. 45°

B. 90°

C. 180°

D. 360°

3.2 Mensuration

3.2.1 Questions

1. Calculate the arc length of a sector with radius 14 cm and central angle 45°. (Take $\pi = 22/7$).

   A. 9 cm

   B. 11 cm

   C. 13 cm

   D. 15 cm

2. Find the area of a sector with radius 7 cm and angle 60° at the center. (Take $\pi = 22/7$).

   A. 25.67 cm^2

   B. 28.33 cm^2

   C. 30.25 cm^2

   D. 32.50 cm^2

3. The volume of a cylinder with radius 7 cm and height 10 cm is: (Take $\pi = 22/7$).

   A. 1540 cm^3

   B. 1100 cm^3

   C. 770 cm^3

   D. 440 cm^3

4. Calculate the curved surface area of a cone with radius 7 cm and slant height 10 cm. (Take $\pi = 22/7$).

   A. 110 cm^2

   B. 154 cm^2

   C. 220 cm^2

   D. 280 cm^2

5. Find the surface area of a sphere with radius 7 cm. (Take $\pi = 22/7$).

   A. 308 cm^2

   B. 462 cm^2

   C. 616 cm^2

   D. 770 cm^2

6. A sector has arc length 22 cm and radius 7 cm. Find the angle in radians.

   A. $\pi/7$

   B. $\pi/2$

   C. π

   D. 2π

7. Calculate the volume of a cone with base radius 6 cm and height 8 cm. (Take $\pi = 22/7$).

   A. 301.71 cm^3

   B. 352.00 cm^3

   C. 402.29 cm^3

   D. 452.57 cm^3

8. The total surface area of a cylinder with radius 7 cm and height 5 cm is: (Take $\pi = 22/7$).

   A. 308 cm^2

   B. 440 cm^2

   C. 528 cm^2

   D. 616 cm^2

9. Find the volume of a sphere with diameter 14 cm. (Take $\pi = 22/7$).

   A. 1437.33 cm^3

   B. 1372.00 cm^3

   C. 1230.67 cm^3

   D. 1100.50 cm^3

10. A sector has perimeter 32 cm and radius 10 cm. Find the arc length.

    A. 10 cm

    B. 12 cm

    C. 14 cm

    D. 16 cm

11. Calculate the area of a sector with arc length 11 cm and radius 7 cm.

    A. 35.5 cm^2

    B. 38.5 cm^2

    C. 41.5 cm^2

    D. 44.5 cm^2

12. The slant height of a cone with radius 5 cm and vertical height 12 cm is:

    A. 10 cm

    B. 11 cm

    C. 13 cm

    D. 15 cm

13. Find the total surface area of a cone with base radius 7 cm and slant height 10 cm. (Take $\pi = 22/7$).

A. 308 cm^2

B. 374 cm^2

C. 440 cm^2

D. 506 cm^2

14. A cylinder has volume 1540 cm^3 and radius 7 cm. Find its height. (Take $\pi = 22/7$).

A. 8 cm

B. 10 cm

C. 12 cm

D. 14 cm

15. Calculate the volume of a hemisphere with radius 7 cm. (Take $\pi = 22/7$).

A. 616.00 cm^3

B. 718.67 cm^3

C. 821.33 cm^3

D. 924.00 cm^3

16. A sector has angle 120° and arc length 44 cm. Find the radius. (Take $\pi = 22/7$).

A. 18 cm

B. 21 cm

C. 24 cm

D. 27 cm

17. The curved surface area of a cylinder is 880 cm^2 and radius is 7 cm. Find height. (Take $\pi = 22/7$).

A. 15 cm

B. 18 cm

C. 20 cm

D. 22 cm

18. Find the total surface area of a sphere with radius 3.5 cm. (Take $\pi = 22/7$).

A. 110 cm^2

B. 132 cm^2

C. 154 cm^2

D. 176 cm^2

19. A cone has total surface area 704 cm^2, radius 7 cm. Find slant height. (Take $\pi = 22/7$).

A. 20 cm

B. 25 cm

C. 28 cm

D. 32 cm

20. Calculate the arc length subtending angle $\pi/3$ radians in circle of radius 21 cm. (Take $\pi = 22/7$).

A. 18 cm

B. 20 cm

C. 22 cm

D. 24 cm

21. A cylinder has height equal to its diameter. If radius is 7 cm, find volume. (Take $\pi = 22/7$).

A. 2156 cm^3

B. 2310 cm^3

C. 2464 cm^3

D. 2618 cm^3

22. Find area of segment of circle with radius 7 cm and central angle 90°. (Take $\pi = 22/7$).

A. 12.5 cm^2

B. 13.5 cm^2

C. 14.5 cm^2

D. 15.5 cm^2

23. The volume of a cone is 1232 cm^3 and height is 24 cm. Find radius. (Take $\pi = 22/7$).

A. 5 cm

B. 6 cm

C. 7 cm

D. 8 cm

24. A sector of angle 60° has area 462 cm^2. Find radius. (Take $\pi = 22/7$).

A. 18 cm

B. 20 cm

C. 21 cm

D. 24 cm

25. Calculate curved surface area of hemisphere with radius 14 cm. (Take $\pi = 22/7$).

A. 1100 cm^2

B. 1232 cm^2

C. 1364 cm^2

D. 1496 cm^2

26. A cylinder and cone have equal base and height. If cylinder volume is 300 cm^3, find cone volume.

A. 75 cm^3

B. 100 cm^3

C. 150 cm^3

D. 200 cm^3

27. Find the volume of cone with base circumference 44 cm and height 12 cm. (Take $\pi = 22/7$).

A. 588 cm^3

B. 616 cm^3

C. 644 cm^3

D. 672 cm^3

28. A sector has radius 10 cm and area 50 cm^2. Find angle in radians.

A. 0.5

B. 1.0

C. 1.5

D. 2.0

29. Calculate total surface area of hemisphere with diameter 14 cm. (Take $\pi = 22/7$).

A. 396 cm^2

B. 462 cm^2

C. 528 cm^2

D. 594 cm^2

30. The ratio of volumes of sphere and cylinder with same radius and height equal to diameter is:

A. 1 : 2

B. 2 : 3

C. 3 : 4

D. 4 : 3

31. A cone has volume 308 cm^3 and base area 154 cm^2. Find height. (Take $\pi = 22/7$).

A. 4 cm

B. 5 cm

C. 6 cm

D. 7 cm

32. Find arc length of sector with area 77 cm^2 and radius 7 cm. (Take $\pi = 22/7$).

A. 20 cm

B. 22 cm

C. 24 cm

D. 26 cm

33. A cylinder has total surface area 1936 cm^2 and radius 14 cm. Find height. (Take $\pi = 22/7$).

A. 6 cm

B. 8 cm

C. 10 cm

D. 12 cm

34. Calculate volume of sphere inscribed in cube of side 6 cm. (Take $\pi = 22/7$).

A. 113.14 cm^3

B. 123.43 cm^3

C. 133.71 cm^3

D. 144.00 cm^3

35. A cone and sphere have equal radius r. If cone height is $4r$, ratio of their volumes is:

A. 1 : 1

B. 1 : 2

C. 2 : 1

D. 3 : 4

36. Find the sector angle if arc length equals radius of 7 cm.

A. 0.5 radians

B. 1 radian

C. 1.5 radians

D. 2 radians

37. A cylinder has height 10 cm and total surface area 880 cm^2. Find radius. (Take $\pi = 22/7$).

A. 6 cm

B. 7 cm

C. 8 cm

D. 9 cm

38. Calculate volume of cone with slant height 25 cm and base diameter 14 cm. (Take $\pi = 22/7$).

A. 1232 cm^3

B. 1320 cm^3

C. 1408 cm^3

D. 1496 cm^3

39. A sector has perimeter 60 cm and angle 2 radians. Find radius.

A. 12 cm

B. 14 cm

C. 15 cm

D. 16 cm

40. The surface area of sphere is 2464 cm^2. Find diameter. (Take $\pi = 22/7$).

A. 24 cm

B. 26 cm

C. 28 cm

D. 30 cm

41. A cone has curved surface area 550 cm^2 and slant height 25 cm. Find radius. (Take $\pi = 22/7$).

A. 5 cm

B. 6 cm

C. 7 cm

D. 8 cm

42. Calculate area of major sector if minor sector has area 50 cm^2 and circle radius is 10 cm. (Take $\pi = 22/7$).

A. 264.29 cm^2

B. 274.29 cm^2

C. 284.29 cm^2

D. 294.29 cm^2

43. A cylinder and sphere have equal surface areas. If sphere radius is r, find cylinder radius (height = $2r$).

A. $r/2$

B. $2r/3$

C. r

D. $2r$

44. Find the volume of largest cone that can be carved from cube of side 14 cm. (Take $\pi = 22/7$).

A. 718.67 cm^3

B. 796.44 cm^3

C. 874.22 cm^3

D. 952.00 cm^3

45. A sector with angle θ radians and radius r has perimeter P. Express θ in terms of P and r.

A. $(P - 2r)/r$

B. $(P + 2r)/r$

C. $(P - r)/2r$

D. $(P + r)/2r$

46. Calculate the ratio of curved surface areas of cone and hemisphere with equal base radius.

A. $l : r$

B. $l : 2r$

C. $2l : r$

D. $l^2 : 2r^2$

47. A cylinder has diameter 14 cm and height 20 cm. Find cost of painting at Rs. 2 per cm^2. (Take $\pi = 22/7$).

A. Rs. 2156

B. Rs. 2464

C. Rs. 2772

D. Rs. 3080

48. Find volume of sphere whose surface area is 5544 cm^2. (Take $\pi = 22/7$).

A. 38808 cm^3

B. 40824 cm^3

C. 42840 cm^3

D. 44856 cm^3

49. A sector has area A and arc length l. Express radius in terms of A and l.

A. $2A/l$

B. $A/2l$

C. $l/2A$

D. $2l/A$

50. Two cones have equal base. Heights are in ratio 3 : 4. Ratio of volumes is:

A. 3 : 4

B. 9 : 16

C. 27 : 64

D. 4 : 3

51. Calculate perimeter of sector with radius 21 cm and angle 60°. (Take $\pi = 22/7$).

A. 56 cm

B. 60 cm

C. 64 cm

D. 68 cm

52. A cone has volume V and base area A. Find height.

A. $3V/A$

B. $V/3A$

C. $A/3V$

D. V/A

53. The volume of cylinder is 3080 cm^3 and curved surface area is 1540 cm^2. Find radius. (Take $\pi = 22/7$).

A. 5 cm

B. 6 cm

C. 7 cm

D. 8 cm

54. Find angle of sector if its area is $1/8$ of circle area.

A. 30°

B. 36°

C. 45°

D. 60°

55. A sphere and cube have equal surface areas. If cube side is a, find sphere radius.

A. $a/\sqrt{\pi}$

B. $a\sqrt{3/2\pi}$

C. $a\sqrt{6/4\pi}$

D. $a\sqrt{3/\pi}$

56. Calculate total surface area of solid consisting of hemisphere on cylinder. Both have radius 7 cm and cylinder height 10 cm. (Take $\pi = 22/7$).

A. 902 cm^2

B. 968 cm^2

C. 1034 cm^2

D. 1100 cm^2

57. A cone is cut parallel to base at half height. Ratio of volumes of top cone to original cone is:

A. 1 : 2

B. 1 : 4

C. 1 : 8

D. 1 : 16

58. Find arc length subtending angle $5\pi/6$ in circle of radius 12 cm. (Take $\pi = 22/7$).

A. 29.14 cm

B. 31.43 cm

C. 33.71 cm

D. 36.00 cm

59. A cylinder has volume V and height h. Find radius.

A. $\sqrt{V/\pi h}$

B. $\sqrt{V\pi h}$

C. $\sqrt{Vh/\pi}$

D. $\sqrt{\pi V/h}$

60. Calculate volume of cone formed by rolling sector of angle 120° and radius 18 cm. (Take $\pi = 22/7$).

A. 263.03 cm^3

B. 293.03 cm^3

C. 323.03 cm^3

D. 353.03 cm^3

61. Two spheres have radii in ratio 2 : 3. Ratio of their surface areas is:

A. 2 : 3

B. 4 : 9

C. 8 : 27

D. 16 : 81

62. A sector has radius 14 cm and perimeter 50 cm. Find its area. (Take $\pi = 22/7$).

A. 140 cm^2

B. 154 cm^2

C. 168 cm^2

D. 182 cm^2

63. Calculate slant height of cone whose volume is 308 cm^3, base radius 7 cm. (Take $\pi = 22/7$).

A. 10 cm

B. 11 cm

C. 12 cm

D. 13 cm

64. A hemisphere and cone have equal base and height. Ratio of their volumes is:

A. 1 : 1

B. 2 : 1

C. 3 : 2

D. 4 : 3

65. Find the volume of largest sphere that can fit in cube of edge 10 cm. (Take $\pi = 22/7$).

A. 523.81 cm^3

B. 552.38 cm^3

C. 580.95 cm^3

D. 609.52 cm^3

66. A sector area is A, radius is r, and angle is θ radians. Which is correct?

A. $A = r^2\theta/2$

B. $A = r\theta/2$

C. $A = 2r^2\theta$

D. $A = r^2\theta$

67. Calculate cost of painting cylindrical pillar of diameter 0.7 m and height 4 m at Rs. 15 per m^2. (Take $\pi = 22/7$).

A. Rs. 126

B. Rs. 132

C. Rs. 138

D. Rs. 144

68. Two cones have equal volume and base. Heights are in ratio 4 : 9. This is:

A. Possible

B. Impossible

C. Possible only if radii differ

D. Insufficient information

69. Find radius of sphere whose volume equals sum of volumes of two spheres of radii 3 cm and 4 cm.

A. 5 cm

B. 6 cm

C. 7 cm

D. $\sqrt{91}$ cm

70. A sector of radius r and angle θ is bent to form cone. The radius of cone base is:

A. $r\theta/\pi$

B. $r\theta/2\pi$

C. $2r\theta/\pi$

D. r/θ

71. Calculate total surface area of cone with base diameter 10 cm and height 12 cm. (Take $\pi = 22/7$).

A. 282.86 cm^2

B. 292.86 cm^2

C. 302.86 cm^2

D. 312.86 cm^2

72. A cylinder has volume 5544 cm^3 and total surface area 1848 cm^2. Find height. (Take $\pi = 22/7$).

A. 16 cm

B. 18 cm

C. 20 cm

D. 22 cm

73. Two cylinders have equal height. Radii are in ratio 2 : 3. Ratio of volumes is:

A. 2 : 3

B. 4 : 9

C. 8 : 27

D. 6 : 9

74. Find perimeter of segment with radius 14 cm and central angle 90°. (Take $\pi = 22/7$).

A. 41.81 cm

B. 43.81 cm

C. 45.81 cm

D. 47.81 cm

75. A sphere is melted to form cylinder of same radius. If cylinder height is h and sphere radius is r, then:

A. $h = 4r/3$

B. $h = 3r/4$

C. $h = 2r/3$

D. $h = r$

76. Calculate volume of cone whose curved surface area is 4070 cm^2 and slant height 37 cm. (Take $\pi = 22/7$).

A. 12320 cm^3

B. 13440 cm^3

C. 14560 cm^3

D. 15680 cm^3

77. Two spheres have volumes in ratio 8 : 27. Ratio of their radii is:

A. 2 : 3

B. 4 : 9

C. 8 : 27

D. 16 : 81

78. A sector of angle 216° has radius 25 cm. Find perimeter. (Take $\pi = 22/7$).

A. 141.43 cm

B. 143.43 cm

C. 145.43 cm

D. 147.43 cm

79. Find height of cone whose volume and curved surface area are numerically equal. If radius is 7 cm: (Take $\pi = 22/7$).

A. 21 cm

B. 24 cm

C. 27 cm

D. 30 cm

80. A cylinder, cone, and hemisphere have equal base and height (diameter for hemisphere). Ratio of volumes is:

A. 1 : 2 : 3

B. 2 : 3 : 4

C. 3 : 1 : 2

D. 6 : 2 : 4

81. Calculate area of largest circle that can be inscribed in sector of radius 12 cm and angle 60°. (Take $\pi = 22/7$).

A. 28.27 cm^2

B. 30.86 cm^2

C. 33.45 cm^2

D. 36.04 cm^2

82. A sphere of radius 6 cm is dropped into cylindrical vessel of radius 8 cm containing water. Find rise in water level.

A. 3.5 cm

B. 4.0 cm

C. 4.5 cm

D. 5.0 cm

83. Find volume of hollow cylinder with external radius 8 cm, internal radius 6 cm, and height 7 cm. (Take $\pi = 22/7$).

A. 528 cm^3

B. 568 cm^3

C. 608 cm^3

D. 616 cm^3

84. A cone and hemisphere have equal base radii. If volumes are equal, ratio of cone height to radius is:

A. 1 : 1

B. 2 : 1

C. 1 : 2

D. 3 : 2

85. Calculate the area enclosed between two concentric circles of radii 14 cm and 21 cm. (Take $\pi = 22/7$).

A. 770 cm^2

B. 825 cm^2

C. 880 cm^2

D. 935 cm^2

86. A sector is rolled into cone. If sector has angle 120° and radius 9 cm, find curved surface area of cone. (Take $\pi = 22/7$).

A. 84.86 cm^2

B. 88.29 cm^2

C. 91.71 cm^2

D. 95.14 cm^2

87. Two cones have equal slant height. Base radii are in ratio 3 : 5. Ratio of curved surface areas is:

A. 3 : 5

B. 9 : 25

C. 27 : 125

D. 6 : 10

88. Find volume of sphere circumscribing cylinder with radius 3 cm and height 8 cm. (Take $\pi = 22/7$).

A. 523.81 cm^3

B. 552.38 cm^3

C. 580.95 cm^3

D. 609.52 cm^3

89. A sector has area 154 cm^2 and perimeter 44 cm. Find radius. (Take $\pi = 22/7$).

A. 5 cm

B. 6 cm

C. 7 cm

D. 8 cm

90. Calculate total surface area of solid hemisphere placed on cylinder. Both have radius 7 cm, cylinder height 13 cm. (Take $\pi = 22/7$).

A. 1012 cm^2

B. 1078 cm^2

C. 1144 cm^2

D. 1210 cm^2

91. A cone's slant height is twice its base radius. If volume is 1232 cm^3, find slant height. (Take $\pi = 22/7$).

A. 24 cm

B. 26 cm

C. 28 cm

D. 30 cm

92. Calculate the volume of a square-based pyramid with base side 10 cm and height 12 cm.

A. 400 cm^3

B. 600 cm^3

C. 800 cm^3

D. 1200 cm^3

93. Find the area of a trapezoid with parallel sides 10 cm and 15 cm, and height 8 cm.

A. 80 cm^2

B. 100 cm^2

C. 120 cm^2

D. 200 cm^2

94. Calculate the total surface area of a cube with side length 5 cm.

A. 125 cm^2

B. 150 cm^2

C. 100 cm^2

D. 75 cm^2

95. A rectangular tank measures 4 m by 3 m by 2 m. Find its volume.

A. 12 m^3

B. 24 m^3

C. 48 m^3

D. 9 m^3

96. Find the curved surface area of a cylinder with radius 3.5 cm and height 10 cm. (Take $\pi = 22/7$).

A. 110 cm^2

B. 220 cm^2

C. 330 cm^2

D. 440 cm^2

97. Calculate the surface area of a sphere with diameter 14 cm. (Take $\pi = 22/7$).

A. 154 cm^2

B. 308 cm^2

C. 616 cm^2

D. 1232 cm^2

98. Find the area of a circle with radius 10 cm. (Use $\pi = 3.14$).

A. 31.4 cm^2

B. 62.8 cm^2

C. 314 cm^2

D. 100 cm^2

99. A cone has base radius 5 cm and vertical height 12 cm. Find its slant height.

A. 11 cm

B. 13 cm

C. 15 cm

D. 17 cm

100. Calculate the volume of a sphere with radius 3 cm. (Take $\pi = 3.142$).

A. 113.11 cm^3

B. 37.70 cm^3

C. 50.27 cm^3

D. 150.82 cm^3

3.3 Loci

3.3.1 Questions

1. The locus of a point P such that it is always 5 cm from a fixed point O is a:

   A. Straight line
   B. Circle of radius 5 cm
   C. Pair of parallel lines
   D. Perpendicular bisector

2. Points A and B are 8 cm apart. The locus of points equidistant from A and B is:

   A. A circle passing through A and B
   B. The perpendicular bisector of AB
   C. A line parallel to AB
   D. An angle bisector

3. The locus of points at a constant distance of 3 cm from a straight line l consists of:

   A. Two parallel lines, each 3 cm from l
   B. A circle of radius 3 cm
   C. A single line perpendicular to l
   D. Four lines forming a square

4. Two lines AB and CD intersect at point O. The locus of points equidistant from both lines is:

   A. A circle centered at O
   B. The perpendicular bisector of AB
   C. The pair of angle bisectors of the angles formed at O
   D. A line parallel to AB

5. A point P moves such that its distance from a fixed point Q is always 7 cm. What is the locus of P?

   A. A sphere of radius 7 cm
   B. A circle of radius 7 cm centered at Q
   C. A straight line through Q
   D. Two parallel lines 7 cm apart

6. Points X and Y are 10 cm apart. How many points are exactly 6 cm from X and equidistant from X and Y?

   A. 0

B. 1
C. 2
D. 4

7. The locus of the center of a circle that rolls without slipping along a straight line is:

A. A circle
B. A straight line parallel to the given line
C. A curve called a cycloid
D. A perpendicular line

8. A point M is equidistant from two fixed points P and Q which are 12 cm apart. If M is also 8 cm from P, what is the distance from M to Q?

A. 4 cm
B. 8 cm
C. 12 cm
D. 20 cm

9. The locus of points in a plane that are 4 cm from a fixed point O and also 4 cm from another fixed point P where $OP = 6$ cm consists of:

A. 0 points
B. 1 point
C. 2 points
D. Infinitely many points

10. A ladder of length 5 m leans against a wall with its foot on the ground. As the ladder slides down, the locus of its midpoint is:

A. A straight line
B. A circle
C. A quarter circle
D. A parabola

11. Two points A and B are 14 cm apart. The locus of point P such that $\angle APB = 90^\circ$ is:

A. A straight line
B. A circle with AB as diameter
C. The perpendicular bisector of AB
D. Two circles

12. The locus of points at a distance of 5 cm from a circle of radius 3 cm centered at O consists of:

A. A single circle of radius 8 cm
B. Two concentric circles of radii 2 cm and 8 cm
C. A circle of radius 5 cm
D. An ellipse

13. A point P moves such that it is always equidistant from two parallel lines l_1 and l_2 that are 10 cm apart. The locus of P is:

A. A line parallel to both l_1 and l_2, midway between them
B. A circle
C. The perpendicular bisector of the distance between l_1 and l_2
D. Two lines perpendicular to l_1 and l_2

14. Points R and S are 6 cm apart. How many points are 4 cm from R and 5 cm from S?

A. 0
B. 1
C. 2
D. 3

15. The locus of the vertex of a right angle that moves such that its arms always pass through two fixed points A and B is:

A. A straight line
B. A circle with AB as diameter
C. The perpendicular bisector of AB
D. An ellipse

16. A point Q is 8 cm from a fixed point O. How many points are 5 cm from O and equidistant from Q and O?

A. 0
B. 1
C. 2
D. 4

17. The locus of points that are 3 cm from a line segment AB of length 8 cm forms:

A. Two parallel line segments
B. A rectangle with semicircular ends (a stadium shape)
C. A circle
D. An ellipse

18. Two intersecting lines form four angles at their intersection point O. If a point P is equidistant from both lines, then P lies on:

A. A circle centered at O
B. One of the two angle bisectors
C. A line perpendicular to one of the given lines
D. The perpendicular bisector of O

19. Points M and N are 20 cm apart. The number of points that are 12 cm from M and also 12 cm from N is:

A. 0
B. 1
C. 2
D. 4

20. A point moves such that the sum of its distances from two fixed points F_1 and F_2 is constant. The locus is:

A. A circle
B. An ellipse with foci at F_1 and F_2
C. A hyperbola
D. The perpendicular bisector of F_1F_2

21. The locus of centers of all circles passing through two given points A and B is:

A. A circle with center at the midpoint of AB
B. The perpendicular bisector of AB

C. A line parallel to AB
D. A circle with AB as diameter

22. A point P is equidistant from two points A and B where $AB = 16$ cm. If $PA = 10$ cm, then PB equals:

A. 6 cm
B. 10 cm
C. 16 cm
D. 26 cm

23. The locus of points at a perpendicular distance of 6 cm from a straight line is:

A. A single line parallel to the given line
B. Two lines parallel to the given line, one on each side
C. A circle of radius 6 cm
D. A perpendicular line

24. Points C and D are 9 cm apart. How many points are 5 cm from C and 6 cm from D?

A. 0
B. 1
C. 2
D. 3

25. A point P moves such that it is always twice as far from point A as it is from point B, where $AB = 12$ cm. The locus of P is:

A. A straight line
B. A circle
C. An ellipse
D. A hyperbola

26. The locus of points equidistant from three non-collinear points A, B, and C is:

A. The circumcenter of triangle ABC
B. The centroid of triangle ABC
C. The incenter of triangle ABC
D. The orthocenter of triangle ABC

27. A circle of radius 4 cm is centered at point O. How many points are 7 cm from O and also 3 cm from the circle?

A. 0
B. 1
C. 2
D. 4

28. Two points E and F are 5 cm apart. The locus of points P such that $PE = 2 \cdot PF$ forms:

A. A straight line
B. A circle (Circle of Apollonius)
C. The perpendicular bisector of EF
D. Two parallel lines

29. The locus of the midpoint of all chords of a circle that are parallel to a given chord is:

A. A diameter perpendicular to the given chord
B. A chord parallel to the given chord
C. A circle concentric with the given circle
D. The center of the circle

30. A point P is 10 cm from a line l and also 10 cm from a point Q that is 8 cm from line l. How many such points P are possible?

A. 1
B. 2
C. 3
D. 4

31. The locus of points that are 4 cm from a given point and also 4 cm from a given line (not passing through the point) can have:

A. At most 1 point
B. At most 2 points
C. At most 3 points
D. At most 4 points

32. Points G and H are 15 cm apart. The number of points that are 10 cm from G and equidistant from G and H is:

A. 0
B. 1
C. 2
D. 3

33. A point moves such that the difference of its distances from two fixed points is constant. The locus is:

A. A circle
B. An ellipse
C. A hyperbola
D. A parabola

34. The locus of points in a plane at a distance of 5 cm from a circle of radius 3 cm and lying outside the circle is:

A. A circle of radius 2 cm
B. A circle of radius 8 cm
C. An annulus between radii 3 cm and 8 cm
D. Two circles of radii 2 cm and 8 cm

35. Two perpendicular lines intersect at point O. The locus of points equidistant from these two lines forms:

A. A circle centered at O
B. Two perpendicular lines bisecting the angles at O
C. Four lines
D. A square

36. A point P is equidistant from the sides of an angle. The locus of P is:

A. The angle bisector
B. A circle
C. A parallel line
D. The perpendicular bisector

37. Points J and K are 18 cm apart. How many points are 10 cm from J and 10 cm from K?

    A. 0
    B. 1
    C. 2
    D. 4

38. The locus of the center of a circle of radius r that rolls on the outside of a fixed circle of radius R is:

    A. A circle of radius R
    B. A circle of radius $R + r$
    C. A circle of radius $R - r$
    D. A straight line

39. A point is 12 cm from point A and 5 cm from point B where $AB = 13$ cm. How many such points exist?

    A. 0
    B. 1
    C. 2
    D. Infinitely many

40. The locus of points from which tangents of equal length can be drawn to a circle is:

    A. A line perpendicular to the radius
    B. Any point outside the circle
    C. A concentric circle
    D. The center of the circle

41. A point P moves such that its distance from a fixed line l is always equal to its distance from a fixed point F not on l. The locus of P is:

    A. A circle
    B. An ellipse
    C. A parabola
    D. A hyperbola

42. Points L and M are 7 cm apart. How many points are 4 cm from L and also 4 cm from M?

    A. 0
    B. 1
    C. 2
    D. 3

43. The locus of points at a distance of 2 cm from a square of side 6 cm forms:

    A. A larger square
    B. A square with rounded corners
    C. A circle
    D. An octagon

44. A point P is such that $PA^2 + PB^2 = k$ where A and B are fixed points and k is constant. The locus of P is:

    A. A straight line
    B. A circle
    C. An ellipse
    D. A parabola

45. Two parallel lines m and n are 12 cm apart. The locus of points that are 5 cm from m and 7 cm from n consists of:

    A. 0 points
    B. 1 line
    C. 2 lines
    D. 4 lines

46. A point moves such that it is always 3 cm closer to point A than to point B where $AB = 10$ cm. The locus is:

    A. A circle
    B. The perpendicular bisector of AB
    C. A line parallel to AB
    D. A hyperbola

47. The locus of the center of a circle that touches two parallel lines is:

    A. A line perpendicular to both given lines
    B. A line parallel to both given lines, midway between them
    C. A circle
    D. Two parallel lines

48. Points N and O are 20 cm apart. How many points are 15 cm from N and 15 cm from O?

    A. 0
    B. 1
    C. 2
    D. 4

49. A point P moves such that the ratio $\frac{PA}{PB} = 2$ where A and B are fixed points 9 cm apart. The locus of P is:

    A. A straight line
    B. A circle
    C. An ellipse
    D. The perpendicular bisector of AB

50. The locus of points that are 6 cm from point O and also lie on a circle of radius 10 cm centered at O consists of:

    A. 0 points
    B. 1 point
    C. Infinitely many points
    D. The entire circle of radius 10 cm

51. A line segment PQ of length 8 cm moves such that P always lies on line l_1 and Q always lies on line l_2 where $l_1 \perp l_2$. The locus of the midpoint of PQ is:

    A. A straight line
    B. A quarter circle of radius 4 cm
    C. A circle of radius 4 cm
    D. An ellipse

52. Points R and S are 11 cm apart. The number of points that are 7 cm from R and 8 cm from S is:

    A. 0

B. 1
C. 2
D. 3

53. The locus of points equidistant from two concentric circles of radii 4 cm and 8 cm is:

A. A circle of radius 6 cm
B. A circle of radius 12 cm
C. The perpendicular bisector
D. No such locus exists

54. A point P is 5 cm from a line l. How many points are 3 cm from P and 3 cm from line l?

A. 1
B. 2
C. 3
D. 4

55. The locus of the vertices of all right-angled triangles on the same base is:

A. A straight line
B. A circle with the base as diameter
C. The perpendicular bisector of the base
D. Two circles

56. Points T and U are 16 cm apart. How many points are 10 cm from T and equidistant from T and U?

A. 0
B. 1
C. 2
D. 3

57. A point moves such that the product of its distances from two fixed points is constant. The locus is:

A. A circle
B. An ellipse
C. A cassinian oval
D. A hyperbola

58. The locus of points that are 3 cm from a fixed point O and also 3 cm from a fixed line l that is 5 cm from O consists of:

A. 0 points
B. 1 point
C. 2 points
D. 4 points

59. Two lines intersect at $60°$. The locus of points 4 cm from the point of intersection and equidistant from both lines consists of:

A. 2 points
B. 4 points
C. 6 points
D. 8 points

60. A circle of radius 5 cm rolls along a straight line without slipping. The locus of a point on the circumference of the circle is:

A. A straight line parallel to the given line
B. A circle
C. A cycloid
D. A sine wave

61. Points V and W are 13 cm apart. The locus of points P such that $\angle VPW = 90°$ is:

A. A straight line perpendicular to VW
B. A circle with VW as diameter
C. The perpendicular bisector of VW
D. Two circles

62. The locus of points in a plane such that the sum of squares of distances from two fixed points is constant forms:

A. A straight line
B. A circle
C. An ellipse
D. A hyperbola

63. A point P is equidistant from two intersecting lines that meet at $45°$. If P is 6 cm from the point of intersection, how many such points exist?

A. 2
B. 4
C. 6
D. 8

64. The locus of the midpoints of all chords of length 8 cm in a circle of radius 5 cm is:

A. The center of the circle only
B. A circle of radius 3 cm
C. A circle of radius 4 cm
D. A straight line

65. Points X and Y are 24 cm apart. How many points are 15 cm from X and 20 cm from Y?

A. 0
B. 1
C. 2
D. 3

66. A point moves such that its distance from point A is always half its distance from point B where $AB = 12$ cm. The locus is:

A. A straight line
B. A circle
C. The perpendicular bisector of AB
D. A parabola

67. The locus of centers of all circles of radius 3 cm that touch a given line l is:

A. A single line parallel to l
B. Two lines parallel to l, each 3 cm away
C. A circle
D. The line l itself

68. A point P is 8 cm from point A and 6 cm from point B where $AB = 10$ cm. How many such points P exist?

A. 0
B. 1
C. 2
D. Infinitely many

69. The locus of points at a distance of 4 cm from a line segment AB of length 6 cm and lying in the same plane consists of:

A. Two parallel line segments only
B. A rectangle
C. A stadium shape (rectangle with semicircular ends)
D. A circle

70. Points Z and A_1 are 30 cm apart. The number of points that are 18 cm from Z and 18 cm from A_1 is:

A. 0
B. 1
C. 2
D. 4

71. A square $ABCD$ has side length 8 cm. The locus of points equidistant from all four vertices is:

A. The center of the square only
B. A circle passing through all vertices
C. The perpendicular bisectors of all sides
D. Four points

72. The locus of points that are 5 cm from a circle of radius 5 cm and lie inside the circle is:

A. A circle of radius 0 cm (the center only)
B. A circle of radius 10 cm
C. No such points exist
D. The entire interior of the circle

73. A point P moves such that $2 \cdot PA = 3 \cdot PB$ where A and B are fixed points. The locus of P is:

A. A straight line
B. A circle (Apollonius circle)
C. The perpendicular bisector of AB
D. An ellipse

74. Two perpendicular lines l_1 and l_2 intersect at point O. The locus of points that are 7 cm from O and equidistant from l_1 and l_2 consists of:

A. 2 points
B. 4 points
C. 6 points
D. 8 points

75. Points B_1 and C_1 are 14 cm apart. How many points are 9 cm from B_1 and 10 cm from C_1?

A. 0
B. 1
C. 2
D. 3

76. A point moves such that its distance from a fixed point is equal to its distance from a fixed circle (not containing the point). The locus is:

A. A circle
B. An ellipse
C. A parabola
D. A conic section depending on the configuration

77. The locus of the center of a circle of radius 4 cm that touches a fixed circle of radius 6 cm externally is:

A. A circle of radius 2 cm
B. A circle of radius 6 cm
C. A circle of radius 10 cm
D. A circle of radius 4 cm

78. A point P is 12 cm from a line l and also 13 cm from a point Q that is 5 cm from line l. How many such points P are possible?

A. 0
B. 1
C. 2
D. 4

79. Points D_1 and E_1 are 25 cm apart. The locus of points equidistant from D_1 and E_1 and also 20 cm from D_1 consists of:

A. 0 points
B. 1 point
C. 2 points
D. 4 points

80. The locus of points from which the angle subtended by a line segment AB is 60° forms:

A. Two circular arcs on opposite sides of AB
B. A complete circle
C. The perpendicular bisector of AB
D. Two straight lines

81. A triangle ABC has $AB = 10$ cm, $BC = 8$ cm, and $AC = 6$ cm. The locus of points equidistant from all three sides is:

A. The circumcenter
B. The centroid
C. The incenter
D. The orthocenter

82. Points F_1 and G_1 are 21 cm apart. How many points are 13 cm from F_1 and 13 cm from G_1?

A. 0
B. 1
C. 2
D. 4

83. The locus of points at which a line segment subtends a constant angle α (where $0^\circ < \alpha < 180^\circ$) forms:

A. Two straight lines
B. Two circular arcs

C. A complete circle
D. An ellipse

84. A point P moves such that $3 \cdot PA = 4 \cdot PB$ where A and B are 14 cm apart. The locus is:

A. A straight line
B. A circle
C. A parabola
D. An ellipse

85. The locus of midpoints of all line segments of length 12 cm with endpoints on two parallel lines 8 cm apart is:

A. A line parallel to the given lines
B. Two lines parallel to the given lines
C. A region between two parallel lines
D. The entire plane

86. Points H_1 and I_1 are 17 cm apart. The number of points that are 10 cm from H_1 and 10 cm from I_1 is:

A. 0
B. 1
C. 2
D. 4

87. A point moves such that the sum of its distances from two perpendicular lines is constant and equals 10 cm. The locus is:

A. A circle
B. A square
C. A straight line
D. A line segment

88. The locus of the vertex of an isosceles triangle with a fixed base AB and constant vertical angle α is:

A. The perpendicular bisector of AB
B. A circle passing through A and B
C. Two circular arcs
D. A straight line through A and B

89. Points J_1 and K_1 are 28 cm apart. How many points are 16 cm from J_1 and 20 cm from K_1?

A. 0
B. 1
C. 2
D. 3

90. A point P is such that the angle $\angle APB = 45^\circ$ where A and B are fixed points 10 cm apart. The complete locus of P consists of:

A. One circular arc
B. Two circular arcs on opposite sides of AB
C. A complete circle
D. Two semicircles

91. The locus of centers of all circles passing through a fixed point P and having radius r is:

A. A point
B. A circle of radius r centered at P
C. A line through P
D. The entire plane

92. Points L_1 and M_1 are 32 cm apart. The locus of points equidistant from L_1 and M_1 and also 25 cm from L_1 consists of:

A. 0 points
B. 1 point
C. 2 points
D. 4 points

93. A rectangle has length 12 cm and width 5 cm. The locus of points equidistant from all four vertices is:

A. The center of the rectangle only
B. A circle
C. The diagonals of the rectangle
D. Four points

94. The locus of points whose distance from a fixed point O is twice their distance from a fixed line l (where O is not on l) is:

A. A circle
B. An ellipse
C. A parabola
D. A hyperbola

95. Points N_1 and O_1 are 19 cm apart. How many points are 12 cm from N_1 and 12 cm from O_1?

A. 0
B. 1
C. 2
D. 4

96. A circle has center O and radius 8 cm. The locus of midpoints of all chords of the circle that have length 12 cm is:

A. The center O only
B. A circle of radius $2\sqrt{7}$ cm
C. A circle of radius 6 cm
D. A circle of radius 4 cm

97. A point moves such that it is always 4 cm from a fixed line and also 4 cm from a fixed point on that line. The locus consists of:

A. 0 points
B. 1 point
C. 2 points
D. 3 points

98. The locus of the center of a circle that passes through two fixed points A and B and has radius r (where $r > \frac{AB}{2}$) is:

A. A single point
B. The perpendicular bisector of AB
C. A circle centered at the midpoint of AB
D. Two points on the perpendicular bisector of AB

99. Points P_1 and Q_1 are 26 cm apart. The number of points that are 17 cm from P_1 and equidistant from P_1 and Q_1 is:

    A. 0
    B. 1
    C. 2
    D. 3

100. A point P moves in a plane such that the absolute difference of its distances from two fixed points is zero. The locus of P is:

    A. A straight line
    B. A circle
    C. The perpendicular bisector of the line joining the two points
    D. A single point

3.4 Trigonometry

3.4.1 Questions

1. In a right-angled triangle, if the opposite side is 5 cm and the hypotenuse is 13 cm, what is $\sin\theta$?

    A. $\frac{5}{12}$
    B. $\frac{5}{13}$
    C. $\frac{12}{13}$
    D. $\frac{13}{5}$

2. A right-angled triangle has an adjacent side of 7 cm and a hypotenuse of 25 cm. Find $\cos\theta$.

    A. $\frac{7}{24}$
    B. $\frac{7}{25}$
    C. $\frac{24}{25}$
    D. $\frac{25}{7}$

3. If $\tan\theta = \frac{3}{4}$, find the value of $\sin\theta$.

    A. $\frac{3}{4}$
    B. $\frac{3}{5}$
    C. $\frac{4}{5}$
    D. $\frac{5}{3}$

4. In a right-angled triangle with opposite side 8 cm and adjacent side 15 cm, find $\tan\theta$.

    A. $\frac{8}{15}$
    B. $\frac{15}{8}$
    C. $\frac{8}{17}$
    D. $\frac{15}{17}$

5. A man standing 20 m from a building observes the top at an angle of elevation of 30°. What is the height of the building?

    A. 10 m
    B. $\frac{20}{\sqrt{3}}$ m
    C. $20\sqrt{3}$ m
    D. 40 m

6. If $\sin\theta = \frac{12}{13}$, find $\cos\theta$.

    A. $\frac{5}{13}$
    B. $\frac{12}{5}$
    C. $\frac{13}{12}$
    D. $\frac{13}{5}$

7. In triangle ABC, $a = 7$ cm, $b = 8$ cm, and $\angle C = 60^\circ$. Find the length of side c using the cosine rule.

    A. $\sqrt{57}$ cm
    B. $\sqrt{85}$ cm
    C. 9 cm
    D. $\sqrt{113}$ cm

8. A triangle has sides $a = 5$ cm, $b = 7$ cm, and $c = 8$ cm. Find $\cos A$.

    A. $\frac{3}{4}$
    B. $\frac{7}{8}$
    C. $\frac{19}{28}$
    D. $\frac{5}{7}$

9. From the top of a cliff 50 m high, the angle of depression to a boat is 25°. How far is the boat from the base of the cliff?

    A. $50\tan 25^\circ$ m
    B. $\frac{50}{\tan 25^\circ}$ m
    C. $50\sin 25^\circ$ m
    D. $\frac{50}{\cos 25^\circ}$ m

10. In triangle PQR, $p = 10$ cm, $\angle Q = 45^\circ$, and $\angle R = 60^\circ$. Find the length of side q using the sine rule.

    A. $\frac{10\sqrt{2}}{\sqrt{3}}$ cm
    B. $\frac{10}{\sqrt{2}}$ cm
    C. $\frac{10\sqrt{3}}{\sqrt{2}}$ cm
    D. $10\sqrt{6}$ cm

11. If $\cos\theta = \frac{5}{13}$, find $\tan\theta$.

    A. $\frac{5}{12}$
    B. $\frac{12}{5}$
    C. $\frac{12}{13}$
    D. $\frac{13}{12}$

12. A ladder 10 m long leans against a wall making an angle of 60° with the ground. How high up the wall does the ladder reach?

    A. 5 m
    B. $5\sqrt{3}$ m

C. $10\sqrt{3}$ m
D. $\frac{10}{\sqrt{3}}$ m

13. Find the area of a triangle with sides $a = 6$ cm, $b = 8$ cm, and included angle $C = 30°$.

A. 12 cm^2
B. 24 cm^2
C. 48 cm^2
D. $12\sqrt{3}$ cm^2

14. Solve for θ in the range $0° \le \theta \le 360°$: $\sin\theta = \frac{1}{2}$.

A. $30°, 150°$
B. $60°, 120°$
C. $30°, 330°$
D. $45°, 135°$

15. A ship sails from port on a bearing of 060° for 30 km. How far east has the ship traveled?

A. 15 km
B. $15\sqrt{3}$ km
C. $30\sin 60°$ km
D. $30\cos 60°$ km

16. If $\sin\theta + \cos\theta = 1$, and $0° \le \theta \le 90°$, find θ.

A. 0° or 90°
B. 30°
C. 45°
D. 60°

17. In triangle ABC, $a = 12$ cm, $b = 9$ cm, and $\angle A = 80°$. Find $\angle B$ using the sine rule.

A. $\sin^{-1}\left(\frac{9\sin 80°}{12}\right)$
B. $\sin^{-1}\left(\frac{12\sin 80°}{9}\right)$
C. $\cos^{-1}\left(\frac{9}{12}\right)$
D. $80° - \sin^{-1}\left(\frac{9}{12}\right)$

18. If $\tan\theta = 1$, find all values of θ in the range $0° \le \theta \le 360°$.

A. $45°, 225°$
B. $30°, 210°$
C. $60°, 240°$
D. $90°, 270°$

19. A tree casts a shadow 15 m long when the angle of elevation of the sun is 40°. Find the height of the tree.

A. $15\sin 40°$ m
B. $15\cos 40°$ m
C. $15\tan 40°$ m
D. $\frac{15}{\tan 40°}$ m

20. Find the value of $\sin^2 30° + \cos^2 30°$.

A. $\frac{1}{2}$
B. $\frac{3}{4}$
C. 1
D. $\frac{\sqrt{3}}{2}$

21. In triangle XYZ, $x = 15$ cm, $y = 20$ cm, and $z = 25$ cm. Find $\angle Z$.

A. 30°
B. 60°
C. 90°
D. 120°

22. A man 1.8 m tall observes the top of a pole at an angle of elevation of 50°. If he is standing 12 m from the pole, find the height of the pole.

A. $12\tan 50°$ m
B. $(12\tan 50° + 1.8)$ m
C. $(12\sin 50° + 1.8)$ m
D. $\frac{12}{\tan 50°}$ m

23. If $\cos\theta = -\frac{1}{2}$ and $90° < \theta < 180°$, find θ.

A. 120°
B. 135°
C. 150°
D. 210°

24. Two sides of a triangle are 8 cm and 11 cm, and the included angle is 70°. Find the area of the triangle.

A. $44\sin 70°$ cm^2
B. $88\sin 70°$ cm^2
C. $44\cos 70°$ cm^2
D. $22\sin 70°$ cm^2

25. From point P, the angle of elevation to the top of a tower is 35°. From point Q, 50 m closer to the tower, the angle is 55°. Find the height of the tower.

A. $\frac{50\tan 35°\tan 55°}{\tan 55° - \tan 35°}$ m
B. $50\tan 35°$ m
C. $50\tan 55°$ m
D. $\frac{50}{\tan 35° + \tan 55°}$ m

26. Solve for θ: $2\sin\theta = \sqrt{3}$, where $0° \le \theta \le 360°$.

A. $60°, 120°$
B. $30°, 150°$
C. $45°, 135°$
D. $60°, 300°$

27. A plane flies on a bearing of 135° for 100 km. How far south has it traveled?

A. 50 km
B. $50\sqrt{2}$ km
C. $100\sin 45°$ km
D. $100\cos 45°$ km

28. In triangle DEF, $d = 13$ cm, $e = 14$ cm, and $f = 15$ cm. Find $\cos D$ using the cosine rule.

A. $\frac{2}{3}$
B. $\frac{3}{5}$
C. $\frac{4}{5}$
D. $\frac{16}{21}$

29. If $\tan\theta = -\sqrt{3}$ and $180° < \theta < 270°$, find θ.

A. 210°
B. 240°
C. 225°
D. 300°

30. A tower stands on level ground. From a point 40 m away, the angle of elevation to the top is 28°. Find the height of the tower.

A. $40\sin 28^\circ$ m
B. $40\cos 28^\circ$ m
C. $40\tan 28^\circ$ m
D. $\frac{40}{\sin 28^\circ}$ m

31. Find the value of $\sin 60^\circ \cos 30^\circ + \cos 60^\circ \sin 30^\circ$.

A. $\frac{1}{2}$
B. $\frac{\sqrt{3}}{2}$
C. 1
D. $\frac{1}{\sqrt{2}}$

32. In triangle ABC, $a = 10$ cm, $b = 14$ cm, and $\angle C = 45^\circ$. Find side c.

A. $2\sqrt{37}$ cm
B. $\sqrt{296 - 140\sqrt{2}}$ cm
C. 12 cm
D. $\sqrt{100 + 196}$ cm

33. A ship sails from port A on a bearing of $N30^\circ E$ for 60 km to port B. How far north of A is port B?

A. 30 km
B. $30\sqrt{3}$ km
C. $60\sin 30^\circ$ km
D. $60\cos 30^\circ$ km

34. Solve for θ: $\cos\theta = 0$, where $0^\circ \le \theta \le 360^\circ$.

A. $0^\circ, 180^\circ$
B. $90^\circ, 270^\circ$
C. $0^\circ, 360^\circ$
D. $45^\circ, 225^\circ$

35. The area of a triangle is 36 cm^2. If two sides are 9 cm and 10 cm, find the included angle.

A. $\sin^{-1}\left(\frac{4}{5}\right)$
B. $\sin^{-1}\left(\frac{3}{5}\right)$
C. $\cos^{-1}\left(\frac{4}{5}\right)$
D. $\tan^{-1}\left(\frac{4}{5}\right)$

36. If $\sin\theta = \frac{3}{5}$ and θ is acute, find $\cos\theta + \tan\theta$.

A. $\frac{7}{5}$
B. $\frac{19}{20}$
C. $\frac{23}{20}$
D. $\frac{9}{5}$

37. From a lighthouse 75 m high, the angle of depression to a ship is 18°. How far is the ship from the base of the lighthouse?

A. $75\tan 18^\circ$ m
B. $\frac{75}{\tan 18^\circ}$ m
C. $75\sin 18^\circ$ m
D. $\frac{75}{\sin 18^\circ}$ m

38. In triangle PQR, $p = 7$ cm, $q = 24$ cm, and $r = 25$ cm. Find $\sin R$.

A. $\frac{7}{25}$
B. $\frac{24}{25}$
C. $\frac{7}{24}$
D. 1

39. Solve for θ: $2\cos\theta + 1 = 0$, where $0^\circ \le \theta \le 360^\circ$.

A. $60^\circ, 300^\circ$
B. $120^\circ, 240^\circ$
C. $135^\circ, 225^\circ$
D. $150^\circ, 210^\circ$

40. A plane flies from town A on a bearing of 240° for 80 km. How far west of A is the plane?

A. 40 km
B. $40\sqrt{3}$ km
C. $80\sin 60^\circ$ km
D. $80\cos 60^\circ$ km

41. In triangle ABC, $a = 9$ cm, $c = 12$ cm, and $\angle B = 120^\circ$. Find side b using the cosine rule.

A. 15 cm
B. $\sqrt{261}$ cm
C. 21 cm
D. $3\sqrt{37}$ cm

42. If $\sin\theta = -\frac{\sqrt{2}}{2}$ and $270^\circ < \theta < 360^\circ$, find θ.

A. 225°
B. 270°
C. 300°
D. 315°

43. A rope from the top of a flagpole to a point on the ground 8 m from its base makes an angle of 65° with the ground. Find the height of the flagpole.

A. $8\sin 65^\circ$ m
B. $8\cos 65^\circ$ m
C. $8\tan 65^\circ$ m
D. $\frac{8}{\cos 65^\circ}$ m

44. Find the value of $\tan 45^\circ + \tan 30^\circ$.

A. $1 + \frac{1}{\sqrt{3}}$
B. $\frac{\sqrt{3}+1}{\sqrt{3}}$
C. $\sqrt{3} + 1$
D. $\frac{2}{\sqrt{3}}$

45. In triangle PQR, $p = 16$ cm, $q = 12$ cm, and $r = 20$ cm. Find $\angle Q$.

A. 30°
B. 37°

C. 53°
D. 90°

46. Two ships leave a port at the same time. One sails on a bearing of 040° at 15 km/h, the other on a bearing of 130° at 20 km/h. How far apart are they after 2 hours?

A. $10\sqrt{13}$ km
B. $20\sqrt{13}$ km
C. 30 km
D. 50 km

47. Solve for θ: $\sin^2\theta = \frac{3}{4}$, where $0^\circ \le \theta \le 180^\circ$.

A. $30^\circ, 150^\circ$
B. $45^\circ, 135^\circ$
C. $60^\circ, 120^\circ$
D. 90°

48. A vertical pole stands on a slope that makes an angle of 10° with the horizontal. From a point 30 m down the slope, the angle of elevation to the top of the pole is 25°. Find the height of the pole.

A. $30\sin 15^\circ$ m
B. $30\sin 25^\circ$ m
C. $30\tan 15^\circ$ m
D. $30\sin 35^\circ$ m

49. If $\cos A = \frac{3}{5}$ and $\cos B = \frac{5}{13}$ where A and B are acute, find $\sin(A + B)$.

A. $\frac{56}{65}$
B. $\frac{63}{65}$
C. $\frac{16}{65}$
D. $\frac{48}{65}$

50. The area of triangle ABC is 50 cm^2. If $a = 10$ cm and $b = 13$ cm, find the possible values of $\angle C$.

A. $\sin^{-1}\left(\frac{10}{13}\right)$ or $180^\circ - \sin^{-1}\left(\frac{10}{13}\right)$
B. $\sin^{-1}\left(\frac{5}{13}\right)$ or $180^\circ - \sin^{-1}\left(\frac{5}{13}\right)$
C. $\sin^{-1}\left(\frac{10}{13}\right)$ only
D. 90°

51. From the top of a building 80 m high, the angles of depression to two cars on opposite sides of the building are 30° and 45°. Find the distance between the cars.

A. $80(1 + \sqrt{3})$ m
B. 160 m
C. $80\sqrt{3}$ m
D. $80(\sqrt{3} - 1)$ m

52. Solve for θ: $\tan^2\theta = 3$, where $0^\circ \le \theta \le 360^\circ$.

A. $60^\circ, 120^\circ, 240^\circ, 300^\circ$
B. $30^\circ, 150^\circ, 210^\circ, 330^\circ$
C. $45^\circ, 135^\circ, 225^\circ, 315^\circ$
D. $60^\circ, 240^\circ$ only

53. In triangle XYZ, $x = 7$ cm, $y = 10$ cm, and $\angle Z = 75^\circ$. Find the area of the triangle.

A. $35\sin 75^\circ$ cm^2
B. $70\sin 75^\circ$ cm^2
C. $35\cos 75^\circ$ cm^2
D. $\frac{35\sin 75^\circ}{2}$ cm^2

54. A plane flies from airport A to airport B on a bearing of 110° for 200 km. What is the eastward displacement?

A. $200\sin 20^\circ$ km
B. $200\cos 20^\circ$ km
C. $200\sin 70^\circ$ km
D. $200\cos 70^\circ$ km

55. If $\sin\theta = \frac{7}{25}$ and $90^\circ < \theta < 180^\circ$, find $\tan\theta$.

A. $-\frac{7}{24}$
B. $\frac{7}{24}$
C. $-\frac{24}{7}$
D. $\frac{24}{7}$

56. In triangle ABC, $a = 11$ cm, $\angle B = 50^\circ$, and $\angle C = 70^\circ$. Find side b using the sine rule.

A. $\frac{11\sin 50^\circ}{\sin 60^\circ}$ cm
B. $\frac{11\sin 60^\circ}{\sin 50^\circ}$ cm
C. $\frac{11\sin 70^\circ}{\sin 50^\circ}$ cm
D. $11\sin 50^\circ$ cm

57. A ladder 6 m long rests against a vertical wall. If the foot of the ladder is 2 m from the wall, find the angle the ladder makes with the ground.

A. $\cos^{-1}\left(\frac{1}{3}\right)$
B. $\sin^{-1}\left(\frac{1}{3}\right)$
C. $\cos^{-1}\left(\frac{2}{3}\right)$
D. $\sin^{-1}\left(\frac{2}{3}\right)$

58. Find all values of θ in the range $0^\circ \le \theta \le 360^\circ$ such that $2\cos^2\theta = 1$.

A. $45^\circ, 135^\circ, 225^\circ, 315^\circ$
B. $60^\circ, 120^\circ, 240^\circ, 300^\circ$
C. $30^\circ, 150^\circ, 210^\circ, 330^\circ$
D. $0^\circ, 90^\circ, 180^\circ, 270^\circ$

59. Two sides of a triangle are 15 cm and 18 cm, enclosing an angle of 100°. Find the third side.

A. $\sqrt{549 + 540\cos 80^\circ}$ cm
B. $\sqrt{549 - 540\cos 80^\circ}$ cm
C. $\sqrt{549 - 540\cos 100^\circ}$ cm
D. $\sqrt{549 + 540\cos 100^\circ}$ cm

60. A man walks 5 km on a bearing of $N60^\circ W$. How far west has he walked?

A. 2.5 km
B. $2.5\sqrt{3}$ km
C. $5\sin 60^\circ$ km
D. $5\cos 60^\circ$ km

61. If $\tan\theta = \frac{5}{12}$ and θ is acute, find $\sec\theta$.

A. $\frac{12}{13}$
B. $\frac{13}{12}$
C. $\frac{5}{13}$
D. $\frac{13}{5}$

62. Solve for θ: $\sin\theta\cos\theta = \frac{1}{4}$, where $0° \le \theta \le 90°$.

A. $30°$
B. $45°$
C. $60°$
D. No solution in the given range

63. In triangle DEF, $d = 20\,\text{cm}$, $e = 21\,\text{cm}$, and $f = 29\,\text{cm}$. Find $\sin F$.

A. $\frac{20}{29}$
B. $\frac{21}{29}$
C. $\frac{420}{841}$
D. 1

64. From a point on level ground, the angle of elevation to the top of a tower is $40°$. After walking 50 m toward the tower, the angle is $60°$. Find the height of the tower.

A. $\frac{50\tan 40°\tan 60°}{\tan 60° - \tan 40°}$ m
B. $50\tan 40°$ m
C. $50\tan 60°$ m
D. $25(\tan 40° + \tan 60°)$ m

65. If $\cos\theta = \frac{8}{17}$ and θ is in the fourth quadrant, find $\sin\theta$.

A. $\frac{15}{17}$
B. $-\frac{15}{17}$
C. $\frac{8}{15}$
D. $-\frac{8}{15}$

66. The bearing of point B from point A is $125°$. Find the bearing of A from B.

A. $235°$
B. $305°$
C. $055°$
D. $215°$

67. In triangle ABC, $b = 8\,\text{cm}$, $c = 10\,\text{cm}$, and $\angle A = 90°$. Find $\sin B$.

A. $\frac{4}{5}$
B. $\frac{3}{5}$
C. $\frac{5}{8}$
D. $\frac{5}{4}$

68. Solve for θ: $4\sin^2\theta - 3 = 0$, where $0° \le \theta \le 360°$.

A. $30°, 150°, 210°, 330°$
B. $45°, 135°, 225°, 315°$
C. $60°, 120°, 240°, 300°$
D. $90°, 270°$

69. A boat sails 40 km on a bearing of $070°$, then 30 km on a bearing of $160°$. How far is it from its starting point?

A. $10\sqrt{13}$ km
B. 50 km
C. $\sqrt{2500 - 2400\cos 90°}$ km
D. 70 km

70. If $\tan A = \frac{3}{4}$ and $\tan B = \frac{5}{12}$ where A and B are acute, find $\tan(A + B)$.

A. $\frac{63}{16}$
B. $\frac{56}{33}$
C. $\frac{16}{63}$
D. $\frac{33}{56}$

71. The area of an equilateral triangle is $16\sqrt{3}\,\text{cm}^2$. Find the length of each side.

A. 4 cm
B. 8 cm
C. 12 cm
D. 16 cm

72. From a point P, the bearing of point Q is $050°$ and the bearing of point R is $140°$. If $PQ = PR = 100$ m, find the distance QR.

A. 100 m
B. $100\sqrt{2}$ m
C. $100\sqrt{3}$ m
D. 200 m

73. Solve for θ: $\cos\theta + \sin\theta = 1$, where $0° \le \theta \le 360°$.

A. $0°, 90°$
B. $0°, 180°$
C. $90°, 270°$
D. $0°, 90°, 360°$

74. In triangle PQR, $p = 13\,\text{cm}$, $q = 14\,\text{cm}$, and $\angle P = 55°$. Find $\angle Q$ using the sine rule.

A. $\sin^{-1}\left(\frac{14\sin 55°}{13}\right)$
B. $\sin^{-1}\left(\frac{13\sin 55°}{14}\right)$
C. $55°$
D. $\cos^{-1}\left(\frac{13}{14}\right)$

75. A vertical tower stands at the center of a circular field of radius 50 m. From a point on the circumference, the angle of elevation to the top of the tower is $35°$. Find the height of the tower.

A. $50\sin 35°$ m
B. $50\cos 35°$ m
C. $50\tan 35°$ m
D. $\frac{50}{\tan 35°}$ m

76. If $\sin\theta = k$ where $-1 \le k \le 1$, find $\sin(180° - \theta)$.

A. $-k$
B. k
C. $1 - k$
D. $\sqrt{1 - k^2}$

77. Two angles of a triangle are 40° and 65°. If the side opposite the 40° angle is 8 cm, find the side opposite the 65° angle.

    A. $\frac{8\sin 65^\circ}{\sin 40^\circ}$ cm
    B. $\frac{8\sin 40^\circ}{\sin 65^\circ}$ cm
    C. $8\sin 65^\circ$ cm
    D. $8\cos 40^\circ$ cm

78. A parallelogram has adjacent sides of lengths 12 cm and 16 cm, with an included angle of 70°. Find the length of the longer diagonal.

    A. $\sqrt{544 - 384\cos 70^\circ}$ cm
    B. $\sqrt{544 + 384\cos 70^\circ}$ cm
    C. $\sqrt{544 - 384\cos 110^\circ}$ cm
    D. $\sqrt{544 + 384\cos 110^\circ}$ cm

79. Solve for θ: $2\sin\theta = \cos\theta$, where $0^\circ \le \theta \le 180^\circ$.

    A. $\tan^{-1}(2)$
    B. $\tan^{-1}\left(\frac{1}{2}\right)$
    C. 30°
    D. 60°

80. From a lighthouse 100 m above sea level, two boats are observed at angles of depression of 20° and 35° on the same side. Find the distance between the boats.

    A. $100\left(\frac{1}{\tan 20^\circ} - \frac{1}{\tan 35^\circ}\right)$ m
    B. $100\left(\frac{1}{\tan 35^\circ} - \frac{1}{\tan 20^\circ}\right)$ m
    C. $100(\tan 35^\circ - \tan 20^\circ)$ m
    D. $\frac{100}{\tan 20^\circ + \tan 35^\circ}$ m

81. If $\cos\theta = -\frac{3}{5}$ and $180^\circ < \theta < 270^\circ$, find $\cot\theta$.

    A. $\frac{3}{4}$
    B. $-\frac{3}{4}$
    C. $\frac{4}{3}$
    D. $-\frac{4}{3}$

82. In triangle ABC, $a = 17$ cm, $b = 15$ cm, and $c = 8$ cm. Find $\cos C$ using the cosine rule.

    A. $\frac{15}{17}$
    B. $\frac{8}{17}$
    C. $\frac{17}{15}$
    D. $\frac{240}{255}$

83. A ship travels 60 km on a bearing of $S40^\circ E$. How far south has it traveled?

    A. $60\sin 40^\circ$ km
    B. $60\cos 40^\circ$ km
    C. $60\sin 50^\circ$ km
    D. $60\cos 50^\circ$ km

84. Solve for θ: $\sin 2\theta = \sin\theta$, where $0^\circ \le \theta \le 180^\circ$.

    A. $0^\circ, 60^\circ, 180^\circ$
    B. $0^\circ, 90^\circ, 180^\circ$
    C. $0^\circ, 120^\circ, 180^\circ$
    D. $30^\circ, 150^\circ$

85. Two towers of heights 30 m and 50 m stand on level ground. If the distance between them is 60 m, find the angle of elevation from the top of the shorter tower to the top of the taller tower.

    A. $\tan^{-1}\left(\frac{1}{3}\right)$
    B. $\tan^{-1}\left(\frac{1}{2}\right)$
    C. $\tan^{-1}\left(\frac{2}{3}\right)$
    D. $\tan^{-1}\left(\frac{3}{4}\right)$

86. If $\tan\theta = -\frac{4}{3}$ and $90^\circ < \theta < 180^\circ$, find $\sin\theta + \cos\theta$.

    A. $\frac{1}{5}$
    B. $-\frac{1}{5}$
    C. $\frac{7}{5}$
    D. $-\frac{7}{5}$

87. In triangle XYZ, $\angle X = 30^\circ$, $\angle Y = 45^\circ$, and $z = 10$ cm. Find side x.

    A. 5 cm
    B. $5\sqrt{2}$ cm
    C. $10\sin 30^\circ$ cm
    D. $\frac{10\sin 30^\circ}{\sin 105^\circ}$ cm

88. A ladder reaches a window 12 m above the ground when inclined at 65° to the horizontal. Find the length of the ladder.

    A. $\frac{12}{\sin 65^\circ}$ m
    B. $\frac{12}{\cos 65^\circ}$ m
    C. $12\sin 65^\circ$ m
    D. $12\tan 65^\circ$ m

89. Find all values of θ satisfying $\cos 2\theta = 0$, where $0^\circ \le \theta \le 180^\circ$.

    A. $45^\circ, 135^\circ$
    B. $30^\circ, 150^\circ$
    C. $60^\circ, 120^\circ$
    D. 90°

90. Two sides of a triangle are 9 cm and 12 cm. If the area is 27 cm^2, find the included angle.

    A. 30° or 150°
    B. 45° or 135°
    C. 60° or 120°
    D. $\sin^{-1}\left(\frac{1}{2}\right)$ or $180^\circ - \sin^{-1}\left(\frac{1}{2}\right)$

91. A plane flies from city A on a bearing of 310° for 150 km to city B. What is the northward displacement?

    A. $150\sin 50^\circ$ km
    B. $150\cos 50^\circ$ km
    C. $150\sin 40^\circ$ km
    D. $150\cos 40^\circ$ km

92. If $\sec\theta = \frac{13}{5}$ and θ is acute, find $\csc\theta$.

    A. $\frac{13}{12}$

B. $\frac{12}{13}$
C. $\frac{5}{12}$
D. $\frac{12}{5}$

93. In triangle ABC, $a = 6$ cm, $b = 8$ cm, and $c = 10$ cm. Find the area of the triangle.

A. 24 cm^2
B. 30 cm^2
C. 40 cm^2
D. 48 cm^2

94. Solve for θ: $\tan\theta + \cot\theta = 2$, where $0° < \theta < 90°$.

A. 30°
B. 45°
C. 60°
D. 75°

95. Two observation posts are 8 km apart. A fire is spotted from both posts with bearings of 045° and 315° respectively from the posts. How far is the fire from the first post?

A. 4 km
B. $4\sqrt{2}$ km
C. 8 km
D. $8\sqrt{2}$ km

96. If $\sin A = \frac{1}{3}$ and $\cos B = \frac{1}{4}$ where A and B are acute, find $\sin(A - B)$.

A. $\frac{1}{12}(4 - \sqrt{30})$
B. $\frac{1}{12}(\sqrt{30} - 4)$
C. $\frac{1}{12}(4\sqrt{2} - \sqrt{15})$
D. $\frac{1}{12}(4 + \sqrt{30})$

97. A rhombus has side length 10 cm and one angle of 60°. Find the length of the shorter diagonal.

A. 5 cm
B. 10 cm
C. $10\sqrt{3}$ cm
D. 20 cm

98. Solve for θ: $3\tan^2\theta = 1$, where $0° \le \theta \le 360°$.

A. 30°, 150°, 210°, 330°
B. 45°, 135°, 225°, 315°
C. 60°, 120°, 240°, 300°
D. 90°, 270°

99. If $\tan\theta = 3/4$ and θ is acute, find $\cos\theta$.

A. 3/5
B. 4/5
C. 5/4
D. 5/3

100. Find the value of $\sin^2 30° + \cos^2 30°$.

A. 1/2
B. $\sqrt{3}/2$
C. 1
D. 0

3.5 Co-ordinate Geometry

3.5.1 Questions

1. Find the distance between points $A(3, 4)$ and $B(6, 8)$

A. 3
B. 4
C. 5
D. 7

2. What is the midpoint of the line joining $(-2, 5)$ and $(4, -3)$?

A. $(1, 1)$
B. $(2, 2)$
C. $(3, 4)$
D. $(-1, -1)$

3. Find the gradient of the line passing through $(2, 3)$ and $(5, 9)$

A. 1
B. 2
C. 3
D. 4

4. The gradient of the line joining $(-2, 0)$ and $(0, -4)$ is

A. -2
B. -1
C. 2
D. 4

5. Find the distance between points $(0, 0)$ and $(3, 4)$

A. 3
B. 4
C. 5
D. 7

6. What is the midpoint between $(6, 8)$ and $(2, 4)$?

A. $(4, 6)$
B. $(8, 12)$

C. $(2, 2)$

D. $(3, 5)$

7. Find the gradient of the line $2y = 4x + 6$

A. 1

B. 2

C. 3

D. 4

8. The distance between $(1, 2)$ and $(4, 6)$ is

A. 3

B. 4

C. 5

D. 7

9. Find the equation of a line with gradient 3 passing through $(0, 2)$

A. $y = 3x + 2$

B. $y = 2x + 3$

C. $y = 3x - 2$

D. $y = x + 5$

10. What is the midpoint of $(10, 14)$ and $(6, 2)$?

A. $(8, 8)$

B. $(16, 16)$

C. $(4, 6)$

D. $(2, 3)$

11. Find the gradient of the line passing through $(0, 5)$ and $(3, 11)$

A. 1

B. 2

C. 3

D. 6

12. The distance between $(-3, 4)$ and $(3, 4)$ is

A. 0

B. 3

C. 6

D. 8

13. Find the gradient of the line $3y + 6x = 9$

A. -2

B. -1

C. 2

D. 3

14. What is the midpoint between $(5, 7)$ and $(9, 11)$?

A. $(7, 9)$

B. $(14, 18)$

C. $(4, 4)$

D. $(2, 2)$

15. Find the distance between $(2, 1)$ and $(5, 5)$

A. 3

B. 4

C. 5

D. 6

16. The gradient of a line parallel to $y = 4x + 1$ is

A. 1

B. 2

C. 4

D. -4

17. Find the midpoint of $(0, 0)$ and $(8, 6)$

A. $(4, 3)$

B. $(8, 6)$

C. $(2, 1.5)$

D. $(16, 12)$

18. What is the gradient of the line passing through $(1, 1)$ and $(4, 7)$?

A. 1

B. 2

C. 3

D. 6

19. Find the distance between $(-1, -1)$ and $(2, 3)$

A. 3

B. 4

C. 5

D. 6

20. The equation of a line with gradient 2 and y-intercept -3 is

A. $y = 2x - 3$

B. $y = -3x + 2$

C. $y = 2x + 3$

D. $y = 3x - 2$

21. Find the midpoint between $(-4, 6)$ and $(10, -2)$

A. $(3, 2)$

B. $(6, 4)$

C. $(7, 4)$

D. $(14, 8)$

22. What is the gradient of the line $y = -3x + 7$?

A. -3

B. 3

C. 7

D. -7

23. Find the distance between $(5, 0)$ and $(0, 12)$

A. 11

B. 12

C. 13

D. 17

24. The gradient of a line perpendicular to $y = 2x + 5$ is

A. 2

B. -2

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

D. $-\frac{1}{2}$

25. Find the midpoint of $(7, 9)$ and $(3, 5)$

A. $(5, 7)$

B. $(10, 14)$

C. $(4, 4)$

D. $(2, 2)$

26. What is the gradient of the line passing through $(2, 5)$ and $(2, 9)$?

A. 0

B. 1

C. undefined

D. 4

27. Find the distance between $(6, 8)$ and $(6, 2)$

A. 0

B. 4

C. 6

D. 10

28. The equation of a line passing through $(3, 4)$ with gradient -1 is

A. $y = -x + 7$

B. $y = x + 1$

C. $y = -x - 1$

D. $y = x + 7$

29. Find the midpoint between $(12, 8)$ and $(4, 16)$

A. $(8, 12)$

B. $(16, 24)$

C. $(6, 6)$

D. $(4, 4)$

30. What is the gradient of a horizontal line?

A. 0

B. 1

C. -1

D. undefined

31. Find the distance between $(8, 15)$ and $(8, 3)$

A. 0

B. 8

C. 12

D. 18

32. The gradient of the line $4y = 8x - 12$ is

A. 1

B. 2

C. 4

D. 8

33. Find the midpoint of $(-5, -3)$ and $(7, 9)$

A. $(1, 3)$

B. $(2, 6)$

C. $(6, 6)$

D. $(12, 12)$

34. What is the gradient of the line passing through $(3, 2)$ and $(7, 2)$?

A. 0

B. 1

C. 4

D. undefined

35. Find the distance between $(0, 5)$ and $(12, 0)$

A. 11

B. 12

C. 13

D. 17

36. The equation of a line with gradient $\frac{1}{2}$ passing through $(4, 3)$ is

A. $y = \frac{1}{2}x + 1$

B. $y = 2x - 5$

C. $y = \frac{1}{2}x - 1$

D. $y = x + 1$

37. Find the midpoint between $(9, 12)$ and $(15, 4)$

A. $(12, 8)$

B. $(24, 16)$

C. $(6, 8)$

D. $(3, 4)$

38. What is the gradient of a vertical line?

A. 0

B. 1

C. -1

D. undefined

39. Find the distance between $(-2, -3)$ and $(4, 5)$

A. 8

B. 9

C. 10

D. 11

40. The gradient of the line $5y - 10x = 15$ is

A. -2

B. 2

C. 5

D. 10

41. Find the midpoint of $(20, 30)$ and $(10, 10)$

A. $(15, 20)$

B. $(30, 40)$

C. $(10, 20)$

D. $(5, 10)$

42. What is the gradient of the line passing through $(-1, 4)$ and $(2, 10)$?

A. 1

B. 2

C. 3

D. 6

43. Find the distance between $(7, 24)$ and $(0, 0)$

A. 24

B. 25

C. 31

D. 7

44. The gradient of a line perpendicular to $y = -\frac{1}{3}x + 4$ is

A. -3

B. $-\frac{1}{3}$

C. $\frac{1}{3}$

D. 3

45. Find the midpoint between $(8, 14)$ and $(12, 6)$

A. $(10, 10)$

B. $(20, 20)$

C. $(4, 8)$

D. $(2, 4)$

46. What is the gradient of the line $y - 3x = 6$?

A. -3

B. 3

C. 6

D. -6

47. Find the distance between $(9, 40)$ and $(0, 0)$

A. 40

B. 41

C. 49

D. 9

48. The equation of a line passing through the origin with gradient 5 is

A. $y = 5x$

B. $y = x + 5$

C. $y = 5x + 1$

D. $y = -5x$

49. Find the midpoint of $(-6, 8)$ and $(14, -4)$

A. $(4, 2)$

B. $(8, 4)$

C. $(10, 6)$

D. $(20, 12)$

50. What is the gradient of the line passing through $(5, 1)$ and $(1, 5)$?

    A. 1
    B. -1
    C. 4
    D. -4

51. Find the distance between $(3, 7)$ and $(6, 11)$

    A. 3
    B. 4
    C. 5
    D. 7

52. The gradient of a line parallel to $y = -5x + 2$ is

    A. -5
    B. 5
    C. 2
    D. -2

53. Find the midpoint between $(18, 24)$ and $(6, 8)$

    A. $(12, 16)$
    B. $(24, 32)$
    C. $(6, 8)$
    D. $(3, 4)$

54. What is the gradient of the line $6y + 12x = 18$?

    A. -2
    B. 2
    C. 6
    D. -6

55. Find the distance between $(10, 24)$ and $(10, 4)$

    A. 0
    B. 10
    C. 20
    D. 28

56. The equation of a line with gradient -3 and y-intercept 5 is

    A. $y = -3x + 5$
    B. $y = 3x + 5$
    C. $y = -3x - 5$
    D. $y = 5x - 3$

57. Find the midpoint of $(25, 35)$ and $(15, 15)$

    A. $(20, 25)$
    B. $(40, 50)$
    C. $(10, 20)$
    D. $(5, 10)$

58. What is the gradient of the line passing through $(0, 3)$ and $(4, 11)$?

    A. 1
    B. 2
    C. 3
    D. 4

59. Find the distance between $(8, 6)$ and $(2, -2)$

    A. 6
    B. 8
    C. 10
    D. 14

60. The gradient of a line perpendicular to $y = \frac{2}{3}x - 1$ is

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

61. Find the midpoint between $(5, 13)$ and $(11, 7)$

    A. $(8, 10)$
    B. $(16, 20)$
    C. $(6, 6)$
    D. $(3, 3)$

62. What is the gradient of the line $2y = -6x + 10$?

    A. -3
    B. 3
    C. -6
    D. 2

63. Find the distance between $(15, 20)$ and $(15, 8)$

    A. 0
    B. 12
    C. 15
    D. 28

64. The equation of a line passing through $(2, 1)$ with gradient 4 is

    A. $y = 4x - 7$

    B. $y = 4x + 7$

    C. $y = 4x - 1$

    D. $y = 2x + 4$

65. Find the midpoint of $(30, 40)$ and $(10, 20)$

    A. $(20, 30)$

    B. $(40, 60)$

    C. $(15, 15)$

    D. $(10, 10)$

66. What is the gradient of the line passing through $(6, 2)$ and $(10, 10)$?

    A. 1

    B. 2

    C. 4

    D. 8

67. Find the distance between $(5, 12)$ and $(0, 0)$

    A. 12

    B. 13

    C. 17

    D. 5

68. The gradient of a line parallel to $y = \frac{1}{4}x - 3$ is

    A. $\frac{1}{4}$

    B. $-\frac{1}{4}$

    C. 4

    D. -4

69. Find the midpoint between $(22, 18)$ and $(14, 10)$

    A. $(18, 14)$

    B. $(36, 28)$

    C. $(8, 8)$

    D. $(4, 4)$

70. What is the gradient of the line $3y + 9x = 12$?

    A. -3

    B. 3

    C. -9

    D. 9

71. Find the distance between $(20, 21)$ and $(20, 5)$

    A. 0

    B. 16

    C. 20

    D. 26

72. The equation of a line with gradient $\frac{3}{4}$ passing through $(8, 5)$ is

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

    B. $y = \frac{3}{4}x + 1$

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

    D. $y = 3x + 4$

73. Find the midpoint of $(16, 22)$ and $(8, 14)$

    A. $(12, 18)$

    B. $(24, 36)$

    C. $(8, 8)$

    D. $(4, 4)$

74. What is the gradient of the line passing through $(7, 5)$ and $(7, 15)$?

    A. 0

    B. 1

    C. 10

    D. undefined

75. Find the distance between $(9, 12)$ and $(0, 0)$

    A. 12

    B. 15

    C. 21

    D. 9

76. The gradient of a line perpendicular to $y = 4x + 7$ is

    A. 4

    B. -4

    C. $\frac{1}{4}$

    D. $-\frac{1}{4}$

77. Find the midpoint between $(28, 36)$ and $(12, 20)$

    A. $(20, 28)$

    B. $(40, 56)$

C. $(16, 16)$

D. $(8, 8)$

78. What is the gradient of the line $y + 5x = 15$?

A. -5

B. 5

C. 15

D. -15

79. Find the distance between $(24, 7)$ and $(0, 0)$

A. 24

B. 25

C. 31

D. 7

80. The equation of a line passing through $(5, 6)$ with gradient -2 is

A. $y = -2x + 16$

B. $y = 2x - 4$

C. $y = -2x - 4$

D. $y = -2x + 6$

81. Find the midpoint of $(35, 45)$ and $(25, 25)$

A. $(30, 35)$

B. $(60, 70)$

C. $(10, 20)$

D. $(5, 10)$

82. What is the gradient of the line passing through $(1, 8)$ and $(5, 20)$?

A. 2

B. 3

C. 4

D. 12

83. Find the distance between $(6, 8)$ and $(1, -4)$

A. 11

B. 12

C. 13

D. 17

84. The gradient of a line parallel to $y = -7x + 3$ is

A. -7

B. 7

C. 3

D. -3

85. Find the midpoint between $(40, 50)$ and $(20, 30)$

A. $(30, 40)$

B. $(60, 80)$

C. $(20, 20)$

D. $(10, 10)$

86. What is the gradient of the line $4y - 8x = 20$?

A. -2

B. 2

C. 4

D. -4

87. Find the distance between $(13, 84)$ and $(13, 0)$

A. 0

B. 13

C. 84

D. 97

88. The equation of a line with gradient 6 and y-intercept -2 is

A. $y = 6x - 2$

B. $y = -6x + 2$

C. $y = 6x + 2$

D. $y = 2x - 6$

89. Find the midpoint of $(50, 60)$ and $(30, 40)$

A. $(40, 50)$

B. $(80, 100)$

C. $(20, 20)$

D. $(10, 10)$

90. What is the gradient of the line passing through $(3, 10)$ and $(9, 22)$?

A. 1

B. 2

C. 3

D. 4

91. Find the distance between $(11, 60)$ and $(0, 0)$

A. 60

B. 61

C. 71

D. 11

92. The gradient of a line perpendicular to $y = -\frac{5}{2}x + 1$ is

A. $-\frac{5}{2}$

B. $\frac{5}{2}$

C. $-\frac{2}{5}$

D. $\frac{2}{5}$

93. Find the midpoint between $(45, 55)$ and $(35, 35)$

A. $(40, 45)$

B. $(80, 90)$

C. $(10, 20)$

D. $(5, 10)$

94. What is the gradient of the line $7y + 14x = 21$?

A. -2

B. 2

C. 7

D. -7

95. Find the coordinate of the midpoint of the line joining $P(-3, 5)$ and $Q(5, -3)$.

A. $(1, 2)$

B. $(2, 1)$

C. $(1, 1)$

D. $(2, 2)$

96. Find the gradient of the line joining $(2, 7)$ and $(5, 1)$.

A. 2

B. -2

C. 3

D. -3

97. $P(-6, 1)$ 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

98. Find the distance between the points $(4, 3)$ and $(1, -1)$.

A. 3

B. 4

C. 5

D. 6

99. Find the equation of the line passing through $(2, 3)$ with gradient -2.

A. $y = -2x + 7$

B. $y = -2x - 7$

C. $y = 2x + 7$

D. $y = 2x - 7$

100. Calculate the area of a triangle with vertices at 0 0, 50 and 0 8.

A. $squareunits$ square units

B. $squareunits$ square units

Chapter 4

Calculus

4.1 Differentiation

4.1.1 Questions

1. The minimum point on the curve $y = x^2 - 6x + 5$ is at:

   A. (1,5)

   B. (2,3)

   C. (3,4)

   D. (-3,4)

   E. (3,-4)

2. At what value of x is the function $y = x^2 + x + 1$ minimum?

   A. -1

   B. $-\frac{1}{2}$

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

   D. 1

3. At what value of x is the function $y = x^2 - 2x - 3$ minimum?

   A. 1

   B. -1

   C. -4

   D. 4

4. Find the maximum value of $y = -x^2 + 2x + 3$.

   A. -4

   B. -1

   C. 1

   D. 4

5. Find the maximum value of $y = 3x^2 - x^3$.

   A. 2

   B. 4

   C. 6

   D. 0

6. Find the minimum value of $y = x^3 - 3x + 1$.

   A. -1

   B. 1

   C. 2

   D. -2

7. Find the value of x for which the function $f(x) = 2x^3 - x^2 - 4x + 4$ has a maximum value.

   A. $\frac{2}{3}$

   B. 1

   C. -1

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

8. Find the value of x for which the function $f(x) = 3x^3 - 9x^2$ is minimum.

   A. 2

   B. 0

   C. 5

   D. 3

9. Find the maximum value of the function $f(x) = 2 + x - x^2$.

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

   B. $\frac{7}{4}$

C. $\frac{3}{2}$

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

10. Find the maximum value of y in the equation $y = 1 - 2x - 3x^2$.

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

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

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

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

11. The minimum value of y in the equation $y = x^2 - 6x + 8$ is:

A. 8

B. 3

C. 0

D. -1

12. Obtain the maximum value of the function $f(x) = x^3 - 12x + 11$.

A. -5

B. -2

C. 2

D. 27

13. Find the value of h if the maximum value of $y = 1 + hx - 3x^2$ is 13.

A. 10

B. 11

C. 12

D. 13

14. 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. 4

B. 5

C. 6

D. 7

15. Find the value of x for which the function $y = x^3 - x$ has a minimum value.

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

B. $-\frac{\sqrt{3}}{3}$

C. $\sqrt{3}$

D. $-\sqrt{3}$

16. If $f(x) = x^2 - 2x - 3$, find the least value of $f(x)$ and the corresponding value of x.

A. $f(x) = -3, x = 1$

B. $f(x) = -3, x = 3$

C. $f(x) = -4, x = 1$

D. $f(x) = 1, x = -4$

17. If $y = 3\cos\left(\frac{x}{3}\right)$, find $\frac{dy}{dx}$ when $x = \frac{3\pi}{2}$.

A. -1

B. 1

C. 2

D. 3

18. What is the rate of change of the volume v of a hemisphere with respect to its radius r when $r = 2$? ($V = \frac{2}{3}\pi r^3$)

A. 2π

B. 4π

C. 8π

D. 16π

19. If $y = (1 - 2x)^3$, find the value of $\frac{dy}{dx}$ at $x = -1$.

A. 22

B. 57

C. -6

D. -54

20. Find the derivative of $y = \sin(2x^3 + 3x - 4)$.

A. $\cos(2x^3 + 3x - 4)$

B. $-\cos(2x^3 + 3x - 4)$

C. $-(6x^2 + 3)\cos(2x^3 + 3x - 4)$

D. $(6x^2 + 3)\cos(2x^3 + 3x - 4)$

21. The radius r of a circular disc is increasing at the rate of 0.5 cm/sec. At what rate is the area of the disc increasing when its radius is 6 cm?

A. 3π cm^2/sec

B. 18π cm^2/sec

C. 6π cm^2/sec

D. 36π cm^2/sec

22. Find $\frac{dy}{dx}$, if $y = \cos x$.

A. $\sin x$

B. $-\sin x$

C. $\tan x$

D. $-\tan x$

23. Differentiate: $(\cos\theta - \sin\theta)^2$ with respect to θ.

A. $1 - 2\cos 2\theta$

B. $-2\sin 2\theta$

C. $-2\cos 2\theta$

D. $1 - 2\sin 2\theta$

24. Differentiate: $\left(x^2 - \frac{1}{x}\right)^2$ with respect to x.

A. $4x^3 - 2 + \frac{2}{x^3}$

B. $4x^3 - 2 - \frac{2}{x^3}$

C. $4x^3 - 4x - \frac{2}{x}$

D. $4x^3 - 3x + \frac{2}{x}$

25. Find the point (x, y) on the Euclidean plane where the curve $y = 2x^2 - 2x + 3$ has 2 as the gradient.

A. $(1, 3)$

B. $(2, 2)$

C. $(3, 4)$

D. $(3, 2)$

26. For what value of x is the tangent to the curve $y = x^2 - 4x + 3$ parallel to the x-axis?

A. 0

B. 1

C. 2

D. 3

27. Differentiate $\frac{6x^3 - 5x^2 + 1}{3x^2}$ with respect to x.

A. $2 - \frac{2}{3x^3}$

B. $2 + \frac{1}{6x}$

C. $2x - \frac{5}{3}$

D. $2 - \frac{1}{3x^2}$

28. If $y = (1 + x)^2$, find $\frac{dy}{dx}$.

A. $x + 1$

B. $2x - 1$

C. $2 + 2x$

D. $1 + 2x$

29. Differentiate $3x^3 + 2x^2 + 3x + 1$ with respect to x.

A. $9x^2 + 4x + 3$

B. $9x^2 + 4x - 3$

C. $9x^2 - 4x - 3$

D. $9x^2 - 4x + 3$

30. Differentiate $\frac{2}{3}x^3 - \frac{4}{x}$.

A. $2x^2 + \frac{4}{x^2}$

B. $2x^2 - \frac{4}{x}$

C. $3x^2 - \frac{4}{x}$

D. $3x^2 + \frac{4}{x^2}$

31. Find the derivative of $\frac{\sin x}{\cos x}$.

A. $\tan x \cos x$

B. $\csc x \sec x$

C. $\sec^2 x$

D. $\cot^2 x$

32. If $y = x^2 - 3x + 4$, find $\frac{dy}{dx}$ at $x = 5$.

A. 9

B. 7

C. 5

D. 3

33. If $y = 2x\cos 2x - \sin 2x$, find $\frac{dy}{dx}$ when $x = \frac{\pi}{2}$.

A. 0

B. $-\pi$

C. π

D. -2π

34. If $y = 3\cos 4x$, find $\frac{dy}{dx}$.

A. $-24\sin 4x$

B. $12\sin 4x$

C. $-12\sin 4x$

D. $6\sin 8x$

35. Find the derivative of $(2 + 3x)(1 - x)$ with respect to x.

A. $6x - 1$

B. $1 - 6x$

C. -3

D. 6

36. Find $\frac{dy}{dx}$, if $y = -3x^3 + 2x^2 - 3x + 1$.

A. $-9x^2 + 4x + 3$

B. $-9x^2 + 4x - 3$

C. $-9x^2 - 4x + 3$

D. $-9x^2 - 4x - 3$

37. If $y = 2x^3 + 6x^2 + 6x + 1$, find $\frac{dy}{dx}$.

A. $6x^2 + 12x + 1$

B. $6x^2 - 12x + 1$

C. $6x^2 + 12x + 6$

D. $6x^2 + 6x + 6$

38. Find the derivative of $y = \left(\frac{1}{3}x + 6\right)^2$.

A. $2\left(\frac{1}{3}x + 6\right)$

B. $\frac{2}{3}\left(\frac{1}{3}x + 6\right)$

C. $\frac{1}{3}\left(\frac{1}{3}x + 6\right)^2$

D. $\frac{2}{3}\left(\frac{1}{3}x + 6\right)^2$

39. If $y = x^2 - 3x + 4$, find $\frac{dy}{dx}$ at $x = 2$.

A. -1

B. 1

C. 2

D. -2

40. If $y = x^2 + \sqrt{x}$, find $\frac{dy}{dx}$.

A. $2x - \frac{1}{2}x^{\frac{1}{2}}$

B. $2x - \frac{1}{2}x^{-\frac{1}{2}}$

C. $2x + x^{-\frac{1}{2}}$

D. $2x + \frac{1}{2}x^{-\frac{1}{2}}$

41. Find $\frac{dy}{dx}$, if $y = \frac{2}{3}x^3 - \frac{4}{x}$.

A. $3x^2 - \frac{4}{x}$

B. $3x^2 + \frac{4}{x^2}$

C. $2x^2 - \frac{4}{x}$

D. $2x^2 + \frac{4}{x^2}$

42. If $y = \cos 3x$, find $\frac{dy}{dx}$.

A. $\frac{1}{3}\sin 3x$

B. $3\sin 3x$

C. $-\frac{1}{3}\sin 3x$

D. $-3\sin 3x$

43. Find $\frac{dy}{dx}$, if $y = \cos x$.

A. $\sin x$

B. $-\sin x$

C. $\tan x$

D. $-\tan x$

44. Find the slope of the curve $y = 2x^2 + 5x - 3$ at $(1, 4)$.

A. 4

B. 6

C. 7

D. 9

45. Find the derivative of $y = \sin^2(5x)$ with respect to x.

A. $5\sin 5x \cos 5x$

B. $2\sin 5x \cos 5x$

C. $15\sin 5x \cos 5x$

D. $10\sin 5x \cos 5x$

46. The slope of the tangent to the curve $y = 3x^2 - 2x + 5$ at the point $(1, 6)$ is:

A. 1

B. 4

C. 5

D. 6

47. If the gradient of the curve $y = 2kx^2 + x + 1$ at $x = 1$ is 9, find the value of k.

A. 2

B. -2

C. 4

D. -4

48. The distance travelled by a particle from a fixed point is given as $s = \left(t^3 - t^2 - t + 5\right)$ cm. Find the minimum distance that the particle can cover from the fixed point (for $t \geq 0$).

    A. 2.3 cm

    B. 4.0 cm

    C. 5.2 cm

    D. 6.0 cm

49. Differentiate $(2x + 5)^2(x - 4)$ with respect to x.

    A. $4(2x + 5)(x - 4)$

    B. $4(2x + 5)(4x - 3)$

    C. $(2x + 5)(6x - 11)$

    D. $(2x + 5)(2x - 13)$

50. Find the rate of change of the volume v of a sphere with respect to its radius r when $r = 1$. ($V = \frac{4}{3}\pi r^3$)

    A. 24π

    B. 12π

    C. 4π

    D. 8π

51. If $y = 2x\cos 2x - \sin 2x$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = \dfrac{\pi}{4}$.

    A. $\dfrac{\pi}{4}$

    B. $\dfrac{\pi}{2}$

    C. $-\pi$

    D. $-\dfrac{\pi}{2}$

52. Differentiate $\dfrac{x}{\cos x}$ with respect to x.

    A. $1 + \sec^2 x$

    B. $1 + x\tan x \sec x$

    C. $\cos x + x\tan x$

    D. $\sec x + x\tan x \sec x$

53. If $y = 243(4x + 5)^{-2}$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = 1$.

    A. $\dfrac{-8}{9}$

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

    C. $\dfrac{-8}{3}$

    D. $\dfrac{3}{8}$

54. What is the derivative of $t^2\sin(3t - 5)$ with respect to the variable t?

    A. $2t\sin(3t - 5) + 3t^2\cos(3t - 5)$

    B. $2t\sin(3t - 5) - 3t^2\cos(3t - 5)$

    C. $6t\cos(3t - 5)$

    D. $2t\sin(3t - 5) + t^2\cos(3t)$

55. A circle with radius 5 cm has its radius increasing at the rate of 0.2 cm/s. What will be the corresponding increase in area?

    A. π

    B. 2π

    C. 4π

    D. 5π

56. Find the dimensions of the rectangle of greatest area which has a fixed perimeter p.

    A. Square of sides $\frac{p}{2}$

    B. Square of sides p

    C. Square of sides $\frac{p}{4}$

    D. Square of sides $2p$

57. The gradient of a curve is $2x + 7$ and the curve passes through the point $(2, 0)$. Find the equation of the curve.

    A. $y = x^2 + 7x - 18$

    B. $y = x^2 + 7x + 18$

    C. $y = x^2 + 7x - 9$

    D. $y = x^2 + 7x + 9$

58. Differentiate $y = \sqrt[3]{x^2}(2x - x^2)$.

    A. $\dfrac{10x^{\frac{5}{3}}}{3} - \dfrac{8x^{\frac{5}{3}}}{3}$

    B. $\dfrac{10x^{\frac{2}{3}}}{3} - \dfrac{8x^{\frac{5}{3}}}{3}$

    C. $\dfrac{10x^{\frac{5}{3}}}{3} - \dfrac{8x^{\frac{2}{3}}}{3}$

    D. $\dfrac{10x^{\frac{2}{3}}}{3} - \dfrac{8x^{\frac{2}{3}}}{3}$

59. The slope of the tangent to the curve $y = 5x^2 - 3x + 5$ at the point $(1, 6)$ is:

    A. 19

    B. 7

    C. 4

    D. 3

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

A. 18

B. −4

C. 16

D. −6

61. Find the derivative of $y = \ln(4x^3 - 2x)$ (assuming natural logarithm).

A. $\dfrac{4x^2 - 2}{7x + 6}$

B. $\dfrac{12x - 2}{4x^2}$

C. $\dfrac{43x^2 - 2x}{7x}$

D. $\dfrac{12x^2 - 2}{4x^3 - 2x}$

62. Find the derivative of $y = e^x \sin x$.

A. $e^x(\sin x + \cos x)$

B. $e^x(\sin x - \cos x)$

C. $e^x \cos x$

D. $xe^x \sin x$

63. Find the second derivative of $y = 8x^3 - 3x^2 + 7x - 1$.

A. $11x^2 + 6x - 7$

B. $24x^2 - 6x + 7$

C. $48x - 6$

D. $32x + 7$

64. For what value of x is the tangent to the curve $y = x^2 + 6x + 8$ parallel to the x-axis?

A. −3

B. 3

C. 4

D. −4

65. Find the second derivative of $y = x\sin(x)$.

A. $2\cos(x) - x\sin(x)$

B. $\sin(x) - x\cos(x)$

C. $\sin(x) + x\cos(x)$

D. $x\sin(x) - 2\cos(x)$

66. Differentiate $\dfrac{2x}{\sin(x)}$ with respect to x.

A. $2\cot x \sec x(1 + \tan x)$

B. $2\csc x - x\cot x$

C. $2x\csc x + \tan x$

D. $2\csc x(1 - x\cot x)$

67. Find the point (x, y) on the Euclidean plane where the curve $y = 2x^2 - 2x + 3$ has 2 as gradient.

A. $(1, 3)$

B. $(2, 7)$

C. $(3, 15)$

D. $(0, 3)$

68. 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. $y = 2x - 2$

69. Differentiate $y = 20x^{-4} + 9$.

A. $-80x^{-5}$

B. $-80x^5$

C. $80x^{-5}$

D. $80x^5$

70. Differentiate $y = x^2 \ln x$.

A. $x(2\ln x + 1)$

B. $2x\ln x$

C. $x + \ln x$

D. $2x + 1/x$

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

A. −24

B. 30

C. −18

D. −50

72. Find the derivative of $y = \sqrt{1 - x^2}$.

A. $\dfrac{x}{\sqrt{1 - x^2}}$

B. $\dfrac{-x}{\sqrt{1 - x^2}}$

C. $\dfrac{1}{2\sqrt{1 - x^2}}$

D. $\dfrac{-1}{\sqrt{1 - x^2}}$

73. If $y = \arctan(x)$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

A. $\dfrac{1}{1 + x^2}$

B. $\dfrac{-1}{1 + x^2}$

C. $\sec^2 x$

D. $\dfrac{1}{\sqrt{1-x^2}}$

74. Differentiate $y = \dfrac{e^x}{x}$ with respect to x.

A. $\dfrac{e^x(x-1)}{x^2}$

B. $\dfrac{e^x(x+1)}{x^2}$

C. e^x

D. $\dfrac{e^x}{x^2}$

75. The slope of the normal to the curve $y = x^2 - 5x + 2$ at $x = 1$ is:

A. -3

B. $1/3$

C. 3

D. $-1/3$

76. Find $\frac{\mathrm{dy}}{\mathrm{dx}}$ if $y = (x^2+1)^3$.

A. $3x(x^2+1)^2$

B. $6x(x^2+1)^2$

C. $2x(x^2+1)^3$

D. $(x^2+1)^2$

77. Given $f(x) = \dfrac{1}{x}$, find $f''(x)$.

A. $-\dfrac{1}{x^2}$

B. $\dfrac{1}{x^3}$

C. $\dfrac{2}{x^3}$

D. $-\dfrac{2}{x^3}$

78. A function $f(x) = x^3 - 6x^2 + 5$. Find the interval where the function is decreasing.

A. $x < 0$ or $x > 4$

B. $0 < x < 4$

C. $x < 2$ or $x > 6$

D. $2 < x < 6$

79. Find the derivative of $y = \sin(\sqrt{x})$.

A. $\dfrac{\cos(\sqrt{x})}{2\sqrt{x}}$

B. $\cos(\sqrt{x})$

C. $2\sqrt{x}\cos(\sqrt{x})$

D. $\dfrac{-\cos(\sqrt{x})}{2\sqrt{x}}$

80. If $y = \sec x$, find $\frac{\mathrm{dy}}{\mathrm{dx}}$.

A. $\tan^2 x$

B. $\sec x \tan x$

C. $-\sec x \tan x$

D. $\csc x \cot x$

81. Find the gradient of the curve $y = \ln(x^2)$ at $x = 2$.

A. $1/2$

B. 1

C. 2

D. $\ln 4$

82. The position of a particle is given by $s(t) = t^3 - 3t^2 + 3t + 7$. What is its acceleration when velocity is zero?

A. 0

B. 6

C. -6

D. 1

83. Differentiate $y = 5^{2x}$.

A. $5^{2x}\ln 5$

B. $2 \cdot 5^{2x}\ln 5$

C. $2x \cdot 5^{2x-1}$

D. $2 \cdot 5^{2x}$

84. Find the critical points of $f(x) = x + \dfrac{1}{x}$.

A. $x = 0, x = 1$

B. $x = 1, x = -1$

C. $x = 0$ only

D. $x = 1$ only

85. If $y = \cos^2(3x)$, find $\frac{\mathrm{dy}}{\mathrm{dx}}$.

A. $-3\sin(6x)$

B. $6\cos(3x)\sin(3x)$

C. $-2\sin(3x)$

D. $-6\sin(3x)$

86. The derivative of $y = \arcsin(2x)$ is:

A. $\dfrac{1}{\sqrt{1-4x^2}}$

B. $\dfrac{2}{\sqrt{1-4x^2}}$

C. $\dfrac{2}{\sqrt{1-x^2}}$

D. $\dfrac{1}{1+4x^2}$

87. Find the equation of the tangent to $y = e^x$ at $x = 0$.

A. $y = x + 1$

B. $y = x - 1$

C. $y = x$

D. $y = ex$

88. If $f(x) = (x+1)^2(x-1)$, find $f'(0)$.

A. -1

B. 1

C. 0

D. 2

89. Differentiate $y = \log_{10}(x)$.

A. $\dfrac{1}{x}$

B. $\dfrac{\ln 10}{x}$

C. $\dfrac{1}{x \ln 10}$

D. $\dfrac{x}{\ln 10}$

90. For the curve $y = x^2 e^{-x}$, find the x-coordinates of the turning points.

A. $(0, -2)$

B. $(0, 2)$

C. $(1, 2)$

D. $(-1, 0)$

91. If $y = \dfrac{\sin x}{1 + \cos x}$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

A. $\dfrac{1}{1+\cos x}$

B. $\dfrac{\cos x}{(1+\cos x)^2}$

C. $\dfrac{1}{(1+\cos x)^2}$

D. $\dfrac{-\sin x}{(1+\cos x)^2}$

92. Find the derivative of $y = \sqrt{x^2 + a^2}$, where a is a constant.

A. $\dfrac{x}{\sqrt{x^2+a^2}}$

B. $\dfrac{1}{2\sqrt{x^2+a^2}}$

C. $\dfrac{2x}{\sqrt{x^2+a^2}}$

D. $\dfrac{ax}{\sqrt{x^2+a^2}}$

93. The minimum value of $f(x) = x^2 + \dfrac{16}{x}$ for $x > 0$ is:

A. 8

B. 12

C. 16

D. 4

94. Differentiate $y = x^x$ with respect to x.

A. xx^{x-1}

B. $x^x \ln x$

C. $x^x(1 + \ln x)$

D. x^x

95. If $y = \dfrac{1}{x^n}$, find $\frac{\mathrm{d}y}{\mathrm{d}x}$.

A. $\dfrac{n}{x^{n+1}}$

B. $\dfrac{-n}{x^{n-1}}$

C. $\dfrac{-n}{x^{n+1}}$

D. nx^{n-1}

96. What is the slope of the tangent to the curve $y = \sqrt{x}$ at $x = 4$?

A. $1/4$

B. $1/2$

C. 2

D. 4

97. Find the second derivative of $y = \ln(x)$.

A. $1/x^2$

B. $-1/x^2$

C. $1/x$

D. $-1/x$

98. If the radius of a sphere is increasing at 2 cm/s, find the rate of increase of its volume when the radius is 3 cm. ($V = \frac{4}{3}\pi r^3$)

A. 24π cm^3/s

B. 36π cm^3/s

C. 72π cm^3/s

D. 12π cm^3/s

99. The function $y = |x - 2|$ is not differentiable at:

    A. $x = 0$
    B. $x = 1$
    C. $x = 2$
    D. All points

100. Differentiate $y = \tan(3x + 2)$ with respect to x.

    A. $3\sec^2(3x + 2)$
    B. $\sec^2(3x + 2)$
    C. $3\cot(3x + 2)$
    D. $-3\sec^2(3x + 2)$

4.2 Integration

4.2.1 Questions

1. Find the integral of $y = 3x^2 - 2x - 1$ with respect to x.

    A. $x^3 - x^2 - x + C$
    B. $x^3 + x^2 - x + C$
    C. $x^3 + x^2 + x + C$
    D. $x^3 - x^2 + x + C$

2. Integrate the expression $6x^2 - 2x + 1$ with respect to x.

    A. $3x^3 - 2x^2 + x + c$
    B. $2x^3 - x^2 + x + c$
    C. $2x^3 - 3x^2 + c$
    D. $x^3 + x^2 - x + c$

3. Integrate $x^{-2} + \cos x$ with respect to x.

    A. $\dfrac{1}{x} + \sin x + k$
    B. $-\dfrac{1}{x} + \sin x + k$
    C. $-\dfrac{1}{x} - \sin x + k$
    D. $\ln|x| + \sin x + k$

4. The expression $ax^2 + bx + c$ equals 5 at $x = 1$. If its derivative is $2x + 1$, what are the values of a, b, c respectively?

    A. 1, 1, 3
    B. 1, 3, 1
    C. 1, 2, 1
    D. 2, 1, 1

5. Integrate the expression $(2x + 1)^3$ with respect to x.

    A. $\dfrac{(2x + 1)^3}{8} + k$
    B. $\dfrac{(2x + 1)^4}{8} + k$
    C. $\dfrac{(2x + 1)^4}{6} + k$
    D. $\dfrac{(2x + 1)^2}{8} + k$

6. Evaluate $\displaystyle\int (4x^{-3} - 7x^2 + 5x - 6)\,\mathrm{d}x$.

    A. $-2x^{-2} - \dfrac{7}{3}x^3 + \dfrac{5}{2}x^2 - 6x + C$
    B. $2x^2 + \dfrac{7}{3}x^3 + 5x^2 - 6 + C$
    C. $12x^2 + 14x - 5 + C$
    D. $-12x^{-4} - 14x + 5 + C$

7. Evaluate $\displaystyle\int_{-1}^{2} \left(2x^2 + x\right)\,\mathrm{d}x$.

    A. $4\frac{1}{2}$
    B. $3\frac{1}{2}$
    C. $7\frac{1}{2}$
    D. $5\frac{1}{4}$

8. Integrate $\dfrac{x^2 - \sqrt{x}}{x}$ with respect to x.

    A. $\dfrac{x^2}{2} - 2\sqrt{x} + k$
    B. $\dfrac{2(x^2 - x)}{3x} + k$
    C. $\dfrac{x^2}{2} - \sqrt{x} + k$
    D. $\dfrac{x^2 - x}{3x} + k$

9. Evaluate $\displaystyle\int_{-1}^{1} (2x + 1)^2\,\mathrm{d}x$.

    A. $3\frac{2}{3}$
    B. 4
    C. $4\frac{1}{3}$
    D. $4\frac{2}{3}$

10. Evaluate $\displaystyle\int (\cos 4x + \sin 3x)\,\mathrm{d}x$.

A. $\sin 4x - \cos 3x + k$

B. $\sin 4x + \cos 3x + k$

C. $\frac{1}{4}\sin 4x - \frac{1}{3}\cos 3x + k$

D. $\frac{1}{4}\sin 4x + \frac{1}{3}\cos 3x + k$

11. Evaluate $\int_0^{\frac{\pi}{2}} \sin x \, dx$.

A. -2

B. -1

C. 1

D. 2

12. Evaluate $\int_1^2 \frac{5}{x} \, dx$.

A. 1.47

B. 2.67

C. 3.23

D. 3.47

13. Evaluate the integral $\int_{\frac{\pi}{12}}^{\frac{\pi}{4}} 2\cos 2x \, dx$.

A. $-\frac{1}{2}$

B. -1

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

D. 1

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

A. $\frac{1}{12}(2x+3)^6 + k$

B. $\frac{1}{3}(2x+3)^{\frac{1}{2}} + k$

C. $\frac{1}{3}(2x+3)^{\frac{3}{2}} + k$

D. $\frac{1}{12}(2x+3)^{\frac{3}{4}} + k$

15. Evaluate $\int \left(\sin x - 5x^2\right) \, dx$.

A. $-\cos x - 10x + k$

B. $\cos x - \frac{5x^3}{3} + k$

C. $-\cos x - \frac{5x^3}{3} + k$

D. $\cos x - 10x + k$

16. Evaluate $\int \sin 2x \, dx$.

A. $\cos 2x + k$

B. $\frac{1}{2}\cos 2x + k$

C. $-\frac{1}{2}\cos 2x + k$

D. $-\cos 2x + k$

17. If $y = x(x^4 + x + 1)$, evaluate $\int_0^1 y \, dx$.

A. $\frac{11}{12}$

B. 1

C. $\frac{5}{6}$

D. 0

18. Evaluate $\int_2^{\pi} (\sec^2 x - \tan^2 x) \, dx$.

A. $\frac{\pi}{2}$

B. $\frac{\pi}{3}$

C. $\pi - 2$

D. $\pi + 2$

19. Evaluate $\int_0^{\frac{\pi}{4}} (\sin x - \cos x) \, dx$.

A. $\sqrt{2} + 1$

B. $\sqrt{2} - 1$

C. $1 - \sqrt{2}$

D. $-\sqrt{2} - 1$

20. Evaluate $\int_{-2}^{1} (x-1)^2 \, dx$.

A. $-\frac{10}{3}$

B. 7

C. 9

D. 11

21. A function $f(x)$ passes through the origin and its first derivative is $3x + 2$. What is $f(x)$?

A. $f(x) = \frac{3x^2}{2} + 2x$

B. $f(x) = \frac{3x^2}{2} + x$

C. $f(x) = 3x^2 + \frac{x}{2}$

D. $f(x) = 3x^2 + 2x$

22. Evaluate $\int_2^3 \left(x^2 - 2x\right)\ \mathrm{d}x$.

A. 4

B. 2

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

D. $\frac{1}{3}$

23. Evaluate $\int_{-4}^0 (1 - 2x)\ \mathrm{d}x$.

A. -20

B. -16

C. 10

D. 20

24. Evaluate $\int_1^2 \left(6x^2 - 2x\right)\ \mathrm{d}x$.

A. 11

B. 12

C. 13

D. 16

25. Evaluate $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \cos x\ \mathrm{d}x$.

A. 0

B. 1

C. 2

D. 3

26. Evaluate $\int_0^2 \left(x^3 + x^2\right)\ \mathrm{d}x$.

A. $4\frac{5}{6}$

B. $6\frac{2}{3}$

C. $1\frac{5}{6}$

D. $2\frac{5}{6}$

27. Evaluate $\int_1^2 2\ \mathrm{d}x$.

A. 3

B. 5

C. 2

D. 6

28. Evaluate $\int_1^2 \left(x^2 - 4x\right)\ \mathrm{d}x$.

A. $\frac{11}{3}$

B. $\frac{3}{11}$

C. $-\frac{3}{11}$

D. $-\frac{11}{3}$

29. Evaluate $\int (\sin x + 2)\ \mathrm{d}x$.

A. $\cos x + x^2 + k$

B. $\cos x + 2x + k$

C. $-\cos x + x^2 + k$

D. $-\cos x + 2x + k$

30. Evaluate $\int \cos 4x\ \mathrm{d}x$.

A. $\frac{3}{4}\sin 4x + k$

B. $-\frac{1}{4}\sin 4x + k$

C. $-\frac{3}{4}\sin 4x + k$

D. $\frac{1}{4}\sin 4x + k$

31. Integrate $\frac{1 + x}{x^3}$ with respect to x.

A. $2x^2 - \frac{1}{x} + k$

B. $x^2 - \frac{1}{x} + k$

C. $-\frac{x^2}{2} - \frac{1}{x} + k$

D. $-\frac{1}{2x^2} - \frac{1}{x} + k$

32. Evaluate $\int \left(x^2 + 3x - 5\right)\ \mathrm{d}x$.

A. $\frac{x^3}{3} - \frac{3x^2}{2} - 5x + k$

B. $\frac{x^3}{3} - \frac{3x^2}{2} + 5x + k$

C. $\frac{x^3}{3} + \frac{3x^2}{2} - 5x + k$

D. $\frac{x^3}{3} + \frac{3x^2}{2} + 5x + k$

33. Integrate $\dfrac{2x^3 + 2x}{x}$ with respect to x.

A. $\dfrac{2x^3}{3} - 2x + k$

B. $\dfrac{2x^3}{3} + 2x + k$

C. $x^3 - 2x + k$

D. $x^3 + 2x + k$

34. Evaluate $\displaystyle\int \left(5x^3 + 7x^2 - 2x + 5\right)\,\mathrm{d}x$.

A. $\dfrac{5x^4}{4} + \dfrac{7x^3}{3} + 2x + C$

B. $\dfrac{5x^4}{4} + \dfrac{7x^3}{3} - x^2 + 5x + C$

C. $\dfrac{5x^3}{3} + \dfrac{7x^2}{2} - x + C$

D. $\dfrac{2x^2}{3} + \dfrac{x}{5} - C$

35. Find the value of $\displaystyle\int_0^{\pi} \frac{\cos^2\theta - 1}{\sin^2\theta}\,\mathrm{d}\theta$.

A. π

B. $-\pi$

C. $\dfrac{\pi}{2}$

D. $-\dfrac{\pi}{2}$

36. The area enclosed by $y = x^2 - 1$, $y = 3$, and $x \geq 0$ is revolved around the y-axis. If the volume is $K\pi$, find K.

A. 7

B. $\dfrac{15}{2}$

C. 8

D. $\dfrac{17}{2}$

37. Evaluate $\displaystyle\int (2x - 5)^4\mathrm{d}x$.

A. $\dfrac{(2x-5)^5}{5} + C$

B. $\dfrac{(2x-5)^5}{10} + C$

C. $8(2x - 5)^3 + C$

D. $\dfrac{(2x-5)^3}{6} + C$

38. Find $\displaystyle\int e^{3x}\mathrm{d}x$.

A. $3e^{3x} + C$

B. $e^{3x} + C$

C. $\dfrac{1}{3}e^{3x} + C$

D. $\dfrac{1}{3}e^{x} + C$

39. Evaluate $\displaystyle\int_0^1 (x^2 - x + 1)\mathrm{d}x$.

A. $\dfrac{1}{6}$

B. $\dfrac{5}{6}$

C. 1

D. $\dfrac{7}{6}$

40. Find $\displaystyle\int \sec^2(3x)\mathrm{d}x$.

A. $\tan(3x) + C$

B. $\dfrac{1}{3}\tan(3x) + C$

C. $3\tan(3x) + C$

D. $\sec(3x)\tan(3x) + C$

41. Evaluate $\displaystyle\int_1^e \frac{1}{x}\mathrm{d}x$.

A. 0

B. 1

C. e

D. $e - 1$

42. Find the area under the curve $y = x^2$ from $x = 0$ to $x = 3$.

A. 3

B. 6

C. 9

D. 27

43. Evaluate $\displaystyle\int \frac{2}{x+1}\mathrm{d}x$.

A. $2\ln|x + 1| + C$

B. $\ln|x + 1| + C$

C. $\dfrac{-2}{(x+1)^2} + C$

D. $2\arctan(x) + C$

44. If $\frac{\mathrm{dy}}{\mathrm{dx}} = 2x - 3$ and $y = 2$ when $x = 1$, find y in terms of x.

A. $y = x^2 - 3x + 2$

B. $y = x^2 - 3x + 4$

C. $y = 2x^2 - 3x + 3$

D. $y = x^2 - 3x$

45. Evaluate $\int_0^{\pi} \cos x \mathrm{d}x$.

A. 0

B. 1

C. -1

D. 2

46. Find $\int (3 - 4x)^{-2} \mathrm{d}x$.

A. $\frac{(3-4x)^{-1}}{-4} + C$

B. $\frac{(3-4x)^{-1}}{4} + C$

C. $\frac{(3-4x)^{-3}}{-12} + C$

D. $-4(3 - 4x)^{-3} + C$

47. What is the area bounded by the curve $y = 4 - x^2$ and the x-axis?

A. $\frac{8}{3}$

B. $\frac{16}{3}$

C. $\frac{32}{3}$

D. 16

48. Evaluate $\int_0^2 (3x^2 + 4x - 5) \mathrm{d}x$.

A. 2

B. 4

C. 6

D. 8

49. Find $\int (x + 1)(x - 2) \mathrm{d}x$.

A. $\frac{x^3}{3} - \frac{x^2}{2} - 2x + C$

B. $\frac{x^3}{3} + \frac{x^2}{2} - 2x + C$

C. $x^2 - x - 2 + C$

D. $\frac{(x+1)^2(x-2)^2}{4} + C$

50. Evaluate $\int_1^4 \sqrt{x} \mathrm{d}x$.

A. $\frac{7}{3}$

B. $\frac{14}{3}$

C. 2

D. 3

51. The gradient of a curve is given by $4x + 3$. If the curve passes through the point $(1, 5)$, find its equation.

A. $y = 2x^2 + 3x$

B. $y = 2x^2 + 3x + 5$

C. $y = 2x^2 + 3x - 0$

D. $y = 4x^2 + 3x - 2$

52. Evaluate $\int e^{-x/2} \mathrm{d}x$.

A. $-2e^{-x/2} + C$

B. $-\frac{1}{2}e^{-x/2} + C$

C. $2e^{-x/2} + C$

D. $e^{-x/2} + C$

53. Find the area enclosed by the curve $y = x^3$, the x-axis, and the lines $x = 1$ and $x = 2$.

A. $\frac{7}{4}$

B. $\frac{15}{4}$

C. 4

D. 7

54. Evaluate $\int_0^{\pi/6} \sec x \tan x \mathrm{d}x$.

A. $\frac{2\sqrt{3}}{3} - 1$

B. $1 - \frac{2\sqrt{3}}{3}$

C. $\frac{\sqrt{3}}{3}$

D. $2 - \sqrt{3}$

55. If $\int_0^a (2x + 1) \mathrm{d}x = 4$, find the positive value of a.

A. 1

B. $\frac{3}{2}$

C. 2

D. 3

56. Find $\int \frac{x^2 + 1}{x^2} \mathrm{d}x$.

A. $x - \frac{1}{x} + C$

B. $x + \frac{1}{x} + C$

C. $1 - \frac{2}{x^3} + C$

D. $2x + C$

57. Evaluate $\int (1-x)^3 \mathrm{d}x$.

A. $\frac{(1-x)^4}{4} + C$

B. $-\frac{(1-x)^4}{4} + C$

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

D. $3(1-x)^2 + C$

58. The area bounded by the curve $y = x$, the x-axis, $x = 0$ and $x = 2$ is revolved around the x-axis. Find the volume of the solid generated.

A. $\frac{2\pi}{3}$

B. $\frac{4\pi}{3}$

C. $\frac{8\pi}{3}$

D. 4π

59. Evaluate $\int_0^{\pi/3} \sin(3x)\mathrm{d}x$.

A. 0

B. $\frac{1}{3}$

C. $\frac{2}{3}$

D. 1

60. Evaluate $\int (x^2+1)^2 dx$.

A. $\frac{x^5}{5} + \frac{2x^3}{3} + x + C$

B. $\frac{(x^2+1)^3}{3} + C$

C. $\frac{x^5}{5} + x^3 + x + C$

D. $\frac{(x^2+1)^3}{6x} + C$

61. If $\int_1^k \frac{1}{x^2} dx = \frac{1}{2}$, find the value of k.

A. 1

B. 2

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

D. 4

62. Find the indefinite integral of $\sec^2 x e^{\tan x}$.

A. $e^{\tan x} + C$

B. $\tan x e^{\tan x} + C$

C. $\sec x e^{\tan x} + C$

D. $e^{\sec^2 x} + C$

63. Evaluate $\int \frac{\ln x}{x} dx$.

A. $\ln|\ln x| + C$

B. $(\ln x)^2 + C$

C. $\frac{1}{2}(\ln x)^2 + C$

D. $\frac{1}{x^2} + C$

64. The area of the region bounded by $y = e^x$, the x-axis, $x = 0$ and $x = 1$ is:

A. e

B. $e - 1$

C. $1 - e$

D. 1

65. Evaluate $\int 2^x \mathrm{d}x$.

A. $2^x + C$

B. $\frac{2^x}{\ln 2} + C$

C. $2^x \ln 2 + C$

D. $x2^{x-1} + C$

66. Evaluate $\int_0^1 (e^x + e^{-x})\mathrm{d}x$.

A. $e - \frac{1}{e}$

B. $e + \frac{1}{e}$

C. $e - \frac{1}{e} - 2$

D. 0

67. Find $\int \frac{1}{2x+3} \mathrm{d}x$.

A. $\ln|2x+3| + C$

B. $2\ln|2x+3| + C$

C. $\frac{1}{2}\ln|2x+3| + C$

D. $\frac{-1}{(2x+3)^2} + C$

68. Find the area bounded by $y = \sin x$, the x-axis, from $x = 0$ to $x = \pi$.

A. 0

B. 1

C. 2

D. π

69. Evaluate $\int xe^{x^2}\mathrm{d}x$.

A. $e^{x^2} + C$

B. $x^2e^{x^2} + C$

C. $\frac{1}{2}e^{x^2} + C$

D. $2e^{x^2} + C$

70. Evaluate $\int_0^{\pi/4} \tan x \sec^2 x \mathrm{d}x$.

A. $\frac{1}{4}$

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

C. 1

D. 2

71. Find $\int \cos^2 x \mathrm{d}x$ (Hint: $\cos 2x = 2\cos^2 x - 1$)

A. $\frac{x}{2} + \frac{\sin 2x}{4} + C$

B. $\frac{x}{2} - \frac{\sin 2x}{4} + C$

C. $x + \sin 2x + C$

D. $\frac{\cos^3 x}{3} + C$

72. If $\int_0^b x\mathrm{d}x = 8$, find $b > 0$.

A. 2

B. 4

C. 8

D. 16

73. Evaluate $\int \frac{1}{\sqrt{1-x^2}}\mathrm{d}x$.

A. $\arcsin x + C$

B. $\arccos x + C$

C. $\ln|\sqrt{1-x^2}| + C$

D. $2\sqrt{1-x^2} + C$

74. The volume generated by revolving the area under $y = \sqrt{x}$ from $x = 0$ to $x = 4$ about the x-axis is:

A. 4π

B. 8π

C. 16π

D. $\frac{8\pi}{3}$

75. Evaluate $\int_{-1}^{1} x^3\mathrm{d}x$.

A. 0

B. $\frac{1}{4}$

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

D. 1

76. Find $\int \frac{e^x}{1+e^x}\mathrm{d}x$.

A. $e^x \ln|1 + e^x| + C$

B. $\ln(1 + e^x) + C$

C. $\frac{e^{2x}}{2+e^x} + C$

D. $\arctan(e^x) + C$

77. Evaluate $\int_1^2 (x + \frac{1}{x})^2\mathrm{d}x$.

A. $\frac{29}{6}$

B. $\frac{17}{3}$

C. 5

D. $\frac{10}{3}$

78. If $\frac{\mathrm{dy}}{\mathrm{dx}} = \sin x + x$ and $y(0) = 1$, find y.

A. $y = \cos x + \frac{x^2}{2}$

B. $y = -\cos x + \frac{x^2}{2} + 1$

C. $y = -\cos x + \frac{x^2}{2} + 2$

D. $y = \cos x + \frac{x^2}{2} + 1$

79. Evaluate $\int 5\mathrm{d}x$.

A. $5 + C$

B. $5x + C$

C. $\frac{x^2}{2} + 5x + C$

D. C

80. Evaluate $\int_0^2 |x-1|\mathrm{d}x$.

A. 0

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

C. 1

D. 2

81. Find $\int \frac{1}{x\ln x}\mathrm{d}x$.

A. $(\ln x)^2 + C$

B. $\ln|\ln x| + C$

C. $\frac{1}{(\ln x)^2} + C$

D. $\ln x^2 + C$

82. The area bounded by $y = 2x$, the x-axis, $x = 1$ and $x = 3$ is:

A. 4

B. 6

C. 8

D. 10

83. Evaluate $\int \sin^2 x\cos x\mathrm{d}x$.

A. $\frac{\sin^3 x}{3} + C$

B. $\frac{\cos^3 x}{3} + C$

C. $\sin x\cos x + C$

D. $2\sin x\cos x + C$

84. $\int_e^{e^2} \frac{\mathrm{d}x}{x\ln x}$.

A. 1

B. $\ln 2$

C. 2

D. e

85. Find $\int (x+1)^5\mathrm{d}x$.

A. $5(x+1)^4 + C$

B. $\frac{(x+1)^6}{6} + C$

C. $(x+1)^6 + C$

D. $\frac{x^6}{6} + x^5 + \cdots + C$

86. Evaluate $\int_0^{\pi/2} \cos^3 x\sin x\mathrm{d}x$.

A. $\frac{1}{4}$

B. $\frac{1}{3}$

C. 0

D. 1

87. The value of $\int_0^1 \frac{dx}{1+x^2}$ is:

A. π

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

C. $\frac{\pi}{4}$

D. 1

88. Integrate $\sqrt{ax+b}$ with respect to x.

A. $\frac{1}{2a\sqrt{ax+b}} + C$

B. $\frac{2}{3a}(ax+b)^{3/2} + C$

C. $\frac{1}{a}(ax+b)^{3/2} + C$

D. $\frac{2}{a}(ax+b)^{1/2} + C$

89. If $f'(x) = x - \frac{1}{x^2}$ and $f(1) = \frac{1}{2}$, find $f(x)$.

A. $\frac{x^2}{2} + \frac{1}{x} + 1$

B. $\frac{x^2}{2} - \frac{1}{x} + 1$

C. $\frac{x^2}{2} + \frac{1}{x} - 1$

D. $\frac{x^2}{2} - \frac{1}{x} - \frac{1}{2}$

90. Evaluate $\int_{-2}^2 (x^3 + \sin x)\mathrm{d}x$.

A. 0

B. 4

C. 8

D. 16/3

91. Find $\int x\sqrt{x^2+1}\mathrm{d}x$.

A. $\frac{1}{2}(x^2+1)^{3/2} + C$

B. $\frac{1}{3}(x^2+1)^{3/2} + C$

C. $(x^2+1)^{1/2} + C$

D. $x^2\sqrt{x^2+1}+C$

92. What is $\int_a^b f(x)\mathrm{d}x+\int_b^c f(x)\mathrm{d}x$?

A. $\int_a^c f(x)\mathrm{d}x$

B. $\int_c^a f(x)\mathrm{d}x$

C. $\int_b^a f(x)\mathrm{d}x+\int_c^b f(x)\mathrm{d}x$

D. 0

93. Evaluate $\int (e^{2x}+e^{-2x})^2\mathrm{d}x$.

A. $\frac{1}{4}e^{4x}+2x-\frac{1}{4}e^{-4x}+C$

B. $\frac{1}{2}e^{4x}+2x-\frac{1}{2}e^{-4x}+C$

C. $e^{4x}+2+e^{-4x}+C$

D. $\frac{(e^{2x}+e^{-2x})^3}{3}+C$

94. Find the area between the curves $y=x^2$ and $y=x$.

A. $\frac{1}{3}$

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

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

D. 1

95. $\int \tan^2 x\mathrm{d}x$.

A. $\sec^2 x-x+C$

B. $\tan x-x+C$

C. $\frac{\tan^3 x}{3}+C$

D. $\ln|\sec x|+C$

96. Evaluate $\int_0^{\ln 2} e^x\mathrm{d}x$.

A. 1

B. 2

C. $2-\ln 2$

D. $\ln 2$

97. Find $\int \frac{\cos x}{1+\sin^2 x}\mathrm{d}x$.

A. $\ln(1+\sin^2 x)+C$

B. $\arctan(\sin x)+C$

C. $\arcsin(\cos x)+C$

D. $\frac{-\sin x}{(1+\sin^2 x)^2}+C$

98. Find the volume of the solid generated by revolving the region bounded by $y=\frac{1}{x}$, the x-axis, from $x=1$ to $x=2$.

A. π

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

C. $\frac{\pi}{3}$

D. 2π

99. Evaluate $\int \frac{2x+3}{x^2+3x+5}\mathrm{d}x$.

A. $2\ln|x^2+3x+5|+C$

B. $\ln|x^2+3x+5|+C$

C. $\frac{1}{2}\ln|x^2+3x+5|+C$

D. $\arctan(x^2+3x+5)+C$

100. Evaluate $\int_0^1 x(x^2+1)^3\mathrm{d}x$.

A. $\frac{15}{8}$

B. $\frac{7}{4}$

C. 22

D. $\frac{17}{8}$

Chapter 5

Combinatorics

5.1 Combination & Permutation

5.1.1 Questions

1. Ralia has 7 different posters to be hung in her bedroom, living room, and kitchen. Assuming she has plans to plant at least a poster in each of the 3 rooms, how many choices does she have?

   A. 49

   B. 170

   C. 210

   D. 21

2. In how many ways can a committee of 2 women and 3 men be chosen from 6 men and 5 women?

   A. 200

   B. 100

   C. 50

   D. 30

3. In how many ways can the letters of the word MATHEMATICS be arranged?

   A. $\frac{11!}{9!2!}$

   B. $\frac{11!}{9!2!2!}$

   C. $\frac{11!}{2!2!2!}$

   D. $\frac{11!}{2!2!}$

4. In how many ways can the letters of the word ACCEPTANCE be arranged?

   A. $\frac{10!}{2!2!3!}$

   B. $\frac{10!}{2!2!}$

   C. 10!

   D. $\frac{10!}{2!3!}$

5. Five people are to be arranged in a row for a group photograph. How many arrangements are there if a married couple in the group insist on sitting next to each other?

   A. 48

   B. 12

   C. 7

   D. 10

6. In how many ways can 6 subjects be selected from 10 subjects for an examination

   A. 215

   B. 218

   C. 216

   D. 210

7. In how many ways can a delegation of 3 be chosen from 5 men and 3 women, if atleast 1 man and 1 woman must be included?

   A. 28

   B. 30

   C. 15

   D. 45

8. Find the number of ways of selecting 6 out of 10 subjects for an examination

   A. 218

   B. 216

C. 210

D. 215

9. In how many ways can the letters of the word ELATION be arranged?

   A. 6!

   B. 7!

   C. 5!

   D. 8!

10. In how many ways can the letters of the word CALCULUS be arranged?

    A. 1680

    B. 2100

    C. 5040

    D. 1760

11. In how many ways can the letters of the word COMBINATION be arranged?

    A. 4989600

    B. 39916800

    C. 19958400

    D. 9979200

12. In how many ways can 7 directors sit round a table?

    A. 24

    B. 5040

    C. 120

    D. 120

13. In how many ways can the letters of the word TOTALITY be arranged?

    A. 6720

    B. 6270

    C. 6207

    D. 6027

14. How many numbers greater than 1000 can be made from the digits 1, 2, 3, 4, and 5 without repeating any one of them?

    A. 152

    B. 210

    C. 216

    D. 144

15. In how many ways can a team of 3 girls be selected from 7 girls?

    A. $\frac{7!}{5!2!}$

    B. $\frac{7!}{3!}$

    C. $\frac{7!}{3!4!}$

    D. $\frac{7!}{4!}$

16. In how many ways can a student select 2 subjects from 5 subjects?

    A. $\frac{5!}{3!2!}$

    B. $\frac{5!}{2!2!}$

    C. $\frac{5!}{2!3!}$

    D. $\frac{5!}{2!}$

17. In how many ways can five people sit round a circular table?

    A. 24

    B. 60

    C. 12

    D. 120

18. How many two-digit numbers can be formed from the digits 0, 1, 2, and 3 if a digit can be repeated and no number may begin with 0?

    A. 4

    B. 12

    C. 16

    D. 20

19. In how many ways can 9 people be seated if 3 chairs are available?

    A. 720

    B. 504

    C. 336

    D. 210

20. A final examination requires that a student answer any 4 out of 6 questions. In how many ways can this be done?

    A. 15

    B. 20

    C. 45

    D. 30

21. In how many ways can 6 coloured chalks be arranged if 2 are of the same colour?

    A. 60

    B. 240

    C. 120

    D. 360

22. How many possible ways are there of seating seven people P,Q,R,S,T,U, and V at a circular table?

    A. 720

    B. 2520

    C. 5040

    D. 360

23. A committee of six is to be formed by a state governor from nine state commissioners and three members of the State House of Assembly. In how many ways can the members of the committee be chosen so as to inlcude one member of the House of the Assembly?

    A. 924 ways

    B. 524 ways

    C. 462 ways

    D. 378 ways

24. How many two-digit numbers can be formed from the digits 0,1, 2, and 3 if a digit can be repeated and no number may begin with 0?

    A. 4

    B. 12

    C. 16

    D. 20

25. Find the number of committees of three that can be formed consisting of two men and one woman from four men and three women

    A. 3

    B. 6

    C. 18

    D. 24

26. In how many ways can 8 people be arranged in a straight line if 2 particular people must not be next to each other?

    A. 30240

    B. 25200

    C. 10080

    D. 5040

27. How many 3-digit numbers can be formed from the digits 1, 2, 3, 4, 5, 6 if no digit is repeated?

    A. 120

    B. 216

    C. 720

    D. 180

28. In how many ways can a president, vice-president, and secretary be chosen from a group of 10 people?

    A. 720

    B. 120

    C. 210

    D. 1000

29. How many different 4-letter arrangements can be made from the word PEPPER?

    A. 60

    B. 72

    C. 84

    D. 96

30. In how many ways can 4 boys and 3 girls be arranged in a row if the girls must sit together?

    A. 720

    B. 1440

    C. 2880

    D. 144

31. A committee of 5 is to be selected from 6 men and 4 women. In how many ways can this be done if there must be exactly 3 men?

    A. 120

    B. 100

    C. 80

    D. 60

32. How many odd 3-digit numbers can be formed from the digits 1, 2, 3, 4, 5 without repetition?

    A. 36

    B. 48

    C. 60

    D. 24

33. In how many ways can 10 books be arranged on a shelf if 3 particular books must always be together?

    A. 241920

    B. 120960

C. 604800

D. 43200

34. A team of 4 people is to be selected from 5 couples. In how many ways can this be done if no couple is selected together?

A. 80

B. 100

C. 120

D. 60

35. In how many ways can the letters of the word PROPORTION be arranged?

A. 907200

B. 1814400

C. 453600

D. 604800

36. How many 5-digit even numbers can be formed using the digits 0, 1, 2, 3, 4 without repetition?

A. 42

B. 48

C. 54

D. 36

37. In how many ways can 5 keys be arranged on a circular key ring?

A. 12

B. 24

C. 60

D. 120

38. A box contains 5 red balls, 4 blue balls, and 3 green balls. In how many ways can 3 balls be selected if all must be of different colors?

A. 60

B. 120

C. 180

D. 240

39. How many numbers between 3000 and 4000 can be formed from the digits 1, 2, 3, 4, 5, 6 if no digit is repeated?

A. 60

B. 120

C. 180

D. 240

40. In how many ways can 8 people sit around a circular table if 2 particular people must sit together?

A. 1440

B. 720

C. 2880

D. 5040

41. A student must answer 5 questions out of 8 in an examination. In how many ways can this be done if the first 3 questions are compulsory?

A. 10

B. 15

C. 20

D. 25

42. In how many ways can the letters of the word STATISTICS be arranged?

A. 50400

B. 100800

C. 25200

D. 151200

43. How many 4-digit numbers divisible by 5 can be formed from the digits 0, 1, 2, 3, 4, 5 without repetition?

A. 120

B. 96

C. 108

D. 84

44. In how many ways can 3 prizes be distributed among 10 students if each student can receive at most one prize?

A. 720

B. 1000

C. 120

D. 210

45. A committee of 6 members is to be formed from 8 men and 5 women. How many committees can be formed with at least 4 men?

A. 1050

B. 980

C. 1120

D. 896

46. In how many ways can 4 different mathematics books and 3 different physics books be arranged on a shelf if books of the same subject must be together?

A. 288

B. 144

C. 576

D. 1152

47. How many 3-letter words (with or without meaning) can be formed from the letters of the word DAUGHTER if no letter is repeated?

A. 336

B. 168

C. 504

D. 252

48. In how many ways can 9 students be divided into 3 groups of 3 each?

A. 280

B. 560

C. 1680

D. 840

49. A password must contain 4 digits. How many different passwords can be formed if the first digit cannot be 0 and repetition is allowed?

A. 9000

B. 10000

C. 5040

D. 6561

50. In how many ways can a captain and vice-captain be selected from a cricket team of 11 players?

A. 110

B. 55

C. 22

D. 121

51. How many diagonals does a decagon (10-sided polygon) have?

A. 35

B. 45

C. 55

D. 65

52. In how many ways can 5 couples be seated in a row if each couple must sit together?

A. 3840

B. 7680

C. 1920

D. 15360

53. A class has 12 students. In how many ways can 4 students be selected to represent the class in a competition?

A. 495

B. 11880

C. 1485

D. 220

54. How many 4-digit numbers greater than 5000 can be formed from the digits 3, 4, 5, 6, 7 if repetition is not allowed?

A. 72

B. 48

C. 60

D. 120

55. In how many ways can the letters of the word EXAMINATION be arranged so that the vowels always occur together?

A. 120960

B. 241920

C. 60480

D. 181440

56. A committee of 7 is to be formed from 5 teachers and 4 students. In how many ways can this be done if there must be more teachers than students?

A. 80

B. 70

C. 60

D. 90

57. In how many ways can 6 beads of different colors be arranged to form a necklace?

A. 60

B. 120

C. 720

D. 30

58. How many 5-digit numbers can be formed from the digits 1, 2, 3, 4, 5, 6 if the number must be divisible by 4 and no digit is repeated?

A. 120

B. 144

C. 168

D. 96

59. In how many ways can 4 boys and 4 girls be seated alternately in a row?

    A. 1152

    B. 576

    C. 2304

    D. 288

60. A bag contains 6 identical red balls and 4 identical blue balls. In how many ways can 5 balls be selected?

    A. 6

    B. 5

    C. 4

    D. 7

61. In how many ways can 10 different books be divided equally between 2 students?

    A. 252

    B. 126

    C. 504

    D. 63

62. How many 3-digit numbers less than 500 can be formed from the digits 1, 2, 3, 4, 5, 6 if no digit is repeated?

    A. 80

    B. 100

    C. 120

    D. 60

63. In how many ways can a team of 11 players be selected from 15 players if 2 particular players must be included?

    A. 715

    B. 286

    C. 364

    D. 455

64. In how many ways can the letters of the word MISSISSIPPI be arranged?

    A. 34650

    B. 69300

    C. 17325

    D. 138600

65. A multiple choice test has 10 questions with 4 options each. In how many ways can a student answer all questions?

    A. 1048576

    B. 40

    C. 5040

    D. 3628800

66. In how many ways can 5 different flags be displayed on 3 poles if each pole must have at least one flag?

    A. 150

    B. 120

    C. 180

    D. 90

67. How many 4-letter arrangements can be made from the letters of the word SUCCESSFUL if all letters are distinct in the arrangement?

    A. 840

    B. 1260

    C. 420

    D. 1680

68. In how many ways can 8 identical balls be distributed among 3 different boxes if each box must contain at least one ball?

    A. 21

    B. 28

    C. 15

    D. 36

69. A committee of 5 members is to be formed from 4 men and 6 women. In how many ways can this be done if there must be at least 2 men and at least 2 women?

    A. 186

    B. 210

    C. 120

    D. 156

70. In how many ways can 7 people be arranged in a circle if 3 particular people must not sit together?

    A. 576

    B. 432

    C. 288

    D. 144

71. How many 5-digit palindromic numbers can be formed using the digits 1, 2, 3, 4, 5?

    A. 125

    B. 120

    C. 25

D. 625

72. In how many ways can 6 men and 4 women be seated in a row such that no two women sit together?

A. 604800

B. 1209600

C. 302400

D. 151200

73. A committee of 4 is to be selected from 6 doctors and 5 engineers. In how many ways can this be done if the committee must have equal numbers of doctors and engineers?

A. 150

B. 200

C. 100

D. 180

74. In how many ways can 5 red balls, 4 blue balls, and 3 green balls be arranged in a row if balls of the same color are identical?

A. 27720

B. 55440

C. 13860

D. 110880

75. How many numbers between 4000 and 5000 can be formed from the digits 2, 3, 4, 5, 6, 7 if no digit is repeated?

A. 60

B. 120

C. 240

D. 180

76. In how many ways can a group of 12 people be divided into three groups of 4 each for three different tasks?

A. 34650

B. 5775

C. 11550

D. 23100

77. How many 6-digit numbers can be formed from the digits 1, 2, 3, 4, 5, 6 if the even digits must occupy even positions?

A. 36

B. 72

C. 18

D. 48

78. In how many ways can 10 students be arranged in a row if 3 particular students must be separated by at least 2 other students?

A. 2419200

B. 1814400

C. 1209600

D. 604800

79. A box contains 5 different English books, 4 different Mathematics books, and 3 different Science books. In how many ways can 3 books be selected if exactly one book of each subject is selected?

A. 60

B. 120

C. 180

D. 220

80. In how many ways can the letters of the word PARALLEL be arranged such that all L's are not together?

A. 3360

B. 2520

C. 6720

D. 1680

81. How many 4-digit even numbers greater than 4000 can be formed from the digits 1, 2, 3, 4, 5, 6 if no digit is repeated?

A. 156

B. 120

C. 144

D. 108

82. In how many ways can 8 people be seated around a circular table if 4 particular people must sit in alternate positions?

A. 144

B. 288

C. 576

D. 72

83. A committee of 6 is to be formed from 7 men and 6 women such that the committee contains at least 3 men and at least 2 women. In how many ways can this be done?

A. 1596

B. 1386

C. 1191

D. 1716

84. In how many ways can 4 different rings be worn on the fingers of one hand (excluding the thumb)?

A. 256

B. 1024

C. 64

D. 16

85. How many 5-letter words can be formed from the letters of the word MONDAY if each word must contain exactly 2 vowels?

A. 720

B. 360

C. 480

D. 240

86. In how many ways can 5 Indian and 4 American delegates be seated at a round table so that all Americans sit together?

A. 2880

B. 5760

C. 1440

D. 720

87. A code consists of 3 letters followed by 2 digits. How many different codes can be formed if the first letter must be a vowel, repetition is allowed, and the digits must be different?

A. 29250

B. 32500

C. 16900

D. 35100

88. In how many ways can 7 different colored beads be arranged on a bracelet?

A. 360

B. 720

C. 2520

D. 180

89. A team of 5 is to be selected from 7 boys and 6 girls. In how many ways can this be done if the team must contain more boys than girls?

A. 1071

B. 756

C. 861

D. 966

90. In how many ways can the letters of the word COMMITTEE be arranged if all vowels must be together and all consonants must be together?

A. 2880

B. 1440

C. 5760

D. 720

91. How many 6-digit numbers can be formed using the digits 0, 1, 2, 3, 4, 5 if the number must be even, greater than 300000, and no digit is repeated?

A. 156

B. 132

C. 144

D. 168

92. In how many ways can 10 identical apples and 6 identical oranges be distributed among 4 children such that each child gets at least one fruit?

A. 252

B. 378

C. 210

D. 504

93. A student must answer 8 questions out of 12 in an examination. In how many ways can this be done if questions 1 and 2 cannot both be omitted?

A. 489

B. 462

C. 495

D. 429

94. In how many ways can 9 different books be distributed equally among 3 students?

A. 1680

B. 280

C. 5040

D. 840

95. How many triangles can be formed by joining the vertices of an octagon?

A. 56

B. 84

C. 28

D. 120

96. In how many ways can 6 students be divided into 2 groups of 3 each for a debate competition?

    A. 10

    B. 20

    C. 30

    D. 40

97. In how many ways can 4 red flags, 3 blue flags, and 2 green flags be arranged in a row if flags of the same color are identical?

    A. 1260

    B. 2520

    C. 630

    D. 5040

98. A password must contain 2 letters followed by 3 digits. How many different passwords can be formed if the letters must be different and the digits must be odd?

    A. 32500

    B. 81250

    C. 65000

    D. 16250

99. In how many ways can a team of 11 cricket players be selected from 8 batsmen and 6 bowlers if the team must include at least 5 batsmen and at least 4 bowlers?

    A. 294

    B. 336

    C. 378

    D. 420

100. How many 7-digit telephone numbers can be formed if the first digit cannot be 0 or 1, and repetition of digits is allowed?

    A. 8000000

    B. 9000000

    C. 7000000

    D. 10000000

5.2 Probability

5.2.1 Questions

1. A bag contains 5 red balls and 3 blue balls. What is the probability of selecting a red ball?

    A. $\frac{5}{8}$

    B. $\frac{3}{8}$

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

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

2. Two dice are thrown together. What is the probability that the sum of the numbers is 7?

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

    B. $\frac{1}{12}$

    C. $\frac{5}{36}$

    D. $\frac{7}{36}$

3. A box contains 4 red, 3 white, and 5 black balls. If one ball is drawn at random, what is the probability that it is not red?

    A. $\frac{2}{3}$

    B. $\frac{1}{3}$

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

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

4. A card is drawn at random from a standard deck of 52 cards. What is the probability of drawing a king?

    A. $\frac{1}{13}$

    B. $\frac{1}{52}$

    C. $\frac{4}{52}$

    D. $\frac{1}{4}$

5. If $P(A) = 0.6$ and $P(B) = 0.4$, and A and B are mutually exclusive events, find $P(A \text{or} B)$.

    A. 1.0

    B. 0.24

    C. 0.8

D. 0.5

6. A bag contains 6 white and 4 black balls. Two balls are drawn at random without replacement. What is the probability that both are white?

   A. $\frac{1}{3}$

   B. $\frac{2}{5}$

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

   D. $\frac{3}{10}$

7. The probability that it will rain tomorrow is 0.7. What is the probability that it will not rain?

   A. 0.3

   B. 0.7

   C. 1.0

   D. 0.5

8. Three coins are tossed simultaneously. What is the probability of getting at least two heads?

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

   B. $\frac{1}{4}$

   C. $\frac{3}{8}$

   D. $\frac{5}{8}$

9. A die is rolled. What is the probability of getting an even number?

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

   B. $\frac{1}{3}$

   C. $\frac{2}{3}$

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

10. A bag contains 8 red and 5 blue marbles. If two marbles are drawn at random with replacement, what is the probability that both are red?

    A. $\frac{64}{169}$

    B. $\frac{8}{13}$

    C. $\frac{56}{169}$

    D. $\frac{40}{169}$

11. From a deck of 52 cards, what is the probability of drawing a heart or a king?

    A. $\frac{4}{13}$

    B. $\frac{17}{52}$

    C. $\frac{13}{52}$

    D. $\frac{16}{52}$

12. A bag contains 5 red, 4 blue, and 3 green balls. What is the probability of drawing a blue ball?

    A. $\frac{1}{3}$

    B. $\frac{1}{4}$

    C. $\frac{5}{12}$

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

13. Two cards are drawn from a deck without replacement. What is the probability that both are aces?

    A. $\frac{1}{221}$

    B. $\frac{4}{663}$

    C. $\frac{1}{169}$

    D. $\frac{2}{221}$

14. A coin is tossed three times. What is the probability of getting exactly two tails?

    A. $\frac{3}{8}$

    B. $\frac{1}{4}$

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

    D. $\frac{1}{8}$

15. If $P(A) = 0.5$, $P(B) = 0.4$, and $P(A \cap B) = 0.2$, find $P(A \cup B)$.

    A. 0.7

    B. 0.9

    C. 0.6

    D. 0.8

16. A box contains 7 red and 5 white balls. Three balls are drawn at random. What is the probability that all are red?

    A. $\frac{7}{44}$

    B. $\frac{35}{264}$

    C. $\frac{1}{12}$

    D. $\frac{7}{22}$

17. A die is rolled twice. What is the probability that the sum is 10?

    A. $\frac{1}{12}$

    B. $\frac{1}{9}$

    C. $\frac{1}{18}$

    D. $\frac{5}{36}$

18. A card is drawn from a deck of 52 cards. What is the probability that it is either a spade or a face card?

    A. $\frac{11}{26}$

    B. $\frac{25}{52}$

    C. $\frac{13}{26}$

    D. $\frac{22}{52}$

19. In a class of 30 students, 18 play football and 12 play basketball. If 8 play both games, what is the probability that a randomly selected student plays at least one game?

    A. $\frac{11}{15}$

    B. $\frac{2}{3}$

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

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

20. A bag contains 4 red, 5 blue, and 6 green balls. Two balls are drawn at random. What is the probability that they are of different colors?

    A. $\frac{37}{70}$

    B. $\frac{74}{105}$

    C. $\frac{31}{70}$

    D. $\frac{33}{70}$

21. What is the probability of getting at least one head when a coin is tossed four times?

    A. $\frac{15}{16}$

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

    C. $\frac{7}{8}$

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

22. A number is selected at random from the numbers 1 to 20. What is the probability that it is divisible by 3 or 5?

    A. $\frac{9}{20}$

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

    C. $\frac{11}{20}$

    D. $\frac{2}{5}$

23. Two dice are rolled. What is the probability that at least one shows a 6?

    A. $\frac{11}{36}$

    B. $\frac{1}{3}$

    C. $\frac{5}{18}$

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

24. A bag contains 3 red, 4 white, and 5 black balls. If three balls are drawn at random, what is the probability that they are of the same color?

    A. $\frac{3}{44}$

    B. $\frac{7}{44}$

    C. $\frac{1}{11}$

    D. $\frac{5}{44}$

25. If the probability of an event is $\frac{3}{7}$, what is the probability of its complement?

    A. $\frac{4}{7}$

B. $\frac{3}{7}$

C. $\frac{1}{7}$

D. $\frac{10}{7}$

26. A letter is chosen at random from the word "MATHEMATICS". What is the probability that it is a vowel?

A. $\frac{4}{11}$

B. $\frac{5}{11}$

C. $\frac{3}{11}$

D. $\frac{6}{11}$

27. Three cards are drawn from a deck without replacement. What is the probability that all three are diamonds?

A. $\frac{11}{850}$

B. $\frac{13}{204}$

C. $\frac{1}{64}$

D. $\frac{1}{52}$

28. A box contains 6 defective and 14 non-defective items. If 3 items are drawn at random, what is the probability that at least one is defective?

A. $\frac{73}{95}$

B. $\frac{22}{95}$

C. $\frac{3}{10}$

D. $\frac{91}{190}$

29. A die is rolled. What is the probability of getting a prime number?

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

B. $\frac{1}{3}$

C. $\frac{2}{3}$

D. $\frac{5}{6}$

30. If two events A and B are independent with $P(A) = 0.6$ and $P(B) = 0.5$, find $P(A \text{and} B)$.

A. 0.3

B. 0.5

C. 0.8

D. 0.25

31. A bag contains 5 red, 6 blue, and 4 green balls. What is the probability of drawing either a red or green ball?

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

B. $\frac{2}{5}$

C. $\frac{1}{3}$

D. $\frac{9}{15}$

32. Four coins are tossed simultaneously. What is the probability of getting exactly three heads?

A. $\frac{1}{4}$

B. $\frac{3}{16}$

C. $\frac{1}{8}$

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

33. A number is chosen at random from 1 to 50. What is the probability that it is a multiple of 7?

A. $\frac{7}{50}$

B. $\frac{1}{7}$

C. $\frac{3}{25}$

D. $\frac{2}{25}$

34. Two events A and B are such that $P(A) = 0.4$, $P(B) = 0.5$, and $P(A \cup B) = 0.7$. Find $P(A \cap B)$.

A. 0.2

B. 0.3

C. 0.1

D. 0.6

35. A bag contains 7 white and 8 black balls. If two balls are drawn at random, what is the probability that one is white and one is black?

A. $\frac{56}{105}$

B. $\frac{8}{15}$

C. $\frac{7}{15}$

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

36. A die is rolled three times. What is the probability of getting three different numbers?

A. $\frac{5}{9}$

B. $\frac{20}{27}$

C. $\frac{2}{3}$

D. $\frac{25}{36}$

37. From a group of 5 men and 4 women, a committee of 3 is selected at random. What is the probability that it contains at least one woman?

A. $\frac{5}{6}$

B. $\frac{37}{42}$

C. $\frac{2}{3}$

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

38. A card is drawn from a deck and replaced. This is done three times. What is the probability of getting exactly two spades?

A. $\frac{9}{64}$

B. $\frac{3}{16}$

C. $\frac{27}{256}$

D. $\frac{1}{8}$

39. In a single throw of two dice, what is the probability of getting a doublet?

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

B. $\frac{1}{12}$

C. $\frac{1}{36}$

D. $\frac{5}{36}$

40. A box contains 4 red, 3 blue, and 5 green marbles. Three marbles are drawn at random without replacement. What is the probability that all three are green?

A. $\frac{1}{22}$

B. $\frac{5}{66}$

C. $\frac{10}{132}$

D. $\frac{1}{11}$

41. If $P(A) = 0.7$, $P(B) = 0.6$, and $P(A \cap B) = 0.4$, find $P(A' \cap B')$.

A. 0.1

B. 0.2

C. 0.3

D. 0.4

42. A letter is chosen at random from the word "PROBABILITY". What is the probability that it is the letter B?

A. $\frac{2}{11}$

B. $\frac{1}{11}$

C. $\frac{3}{11}$

D. $\frac{1}{5}$

43. Three dice are thrown simultaneously. What is the probability that the sum is 10?

A. $\frac{1}{8}$

B. $\frac{25}{216}$

C. $\frac{27}{216}$

D. $\frac{1}{12}$

44. A bag contains 5 white, 7 red, and 8 black balls. If three balls are drawn at random, what is the probability that they are of different colors?

A. $\frac{7}{19}$

B. $\frac{280}{1140}$

C. $\frac{14}{57}$

D. $\frac{140}{570}$

45. A number is selected at random from 1 to 100. What is the probability that it is divisible by both 3 and 5?

A. $\frac{1}{15}$

B. $\frac{2}{25}$

C. $\frac{3}{50}$

D. $\frac{7}{100}$

46. Two cards are drawn from a deck with replacement. What is the probability that both are hearts?

A. $\frac{1}{16}$

B. $\frac{1}{4}$

C. $\frac{13}{204}$

D. $\frac{1}{8}$

47. A box contains 10 items, 3 of which are defective. If 2 items are selected at random without replacement, what is the probability that both are defective?

A. $\frac{1}{15}$

B. $\frac{3}{45}$

C. $\frac{2}{15}$

D. $\frac{1}{10}$

48. A coin is tossed 5 times. What is the probability of getting at least 4 heads?

A. $\frac{3}{16}$

B. $\frac{1}{8}$

C. $\frac{5}{32}$

D. $\frac{6}{32}$

49. From a pack of 52 cards, two cards are drawn at random. What is the probability that both are red?

A. $\frac{25}{102}$

B. $\frac{1}{4}$

C. $\frac{13}{51}$

D. $\frac{26}{51}$

50. A die is rolled. Given that an even number appears, what is the probability that it is 4?

A. $\frac{1}{3}$

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

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

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

51. A bag contains 6 red, 5 blue, and 4 green balls. If two balls are drawn at random with replacement, what is the probability that both are of the same color?

A. $\frac{77}{225}$

B. $\frac{1}{3}$

C. $\frac{37}{105}$

D. $\frac{61}{225}$

52. Three students A, B, and C have probabilities $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{4}$ of solving a problem independently. What is the probability that the problem will be solved?

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

B. $\frac{2}{3}$

C. $\frac{11}{12}$

D. $\frac{5}{6}$

53. A box contains 8 balls numbered 1 to 8. Two balls are drawn at random. What is the probability that their sum is odd?

A. $\frac{4}{7}$

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

C. $\frac{3}{7}$

D. $\frac{16}{28}$

54. A card is drawn from a deck of 52 cards. What is the probability that it is a black card or a queen?

A. $\frac{7}{13}$

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

C. $\frac{28}{52}$

D. $\frac{15}{26}$

55. Four persons are chosen at random from a group of 3 men, 2 women, and 4 children. What is the probability that exactly two of them are children?

    A. $\frac{10}{21}$
    B. $\frac{3}{7}$
    C. $\frac{1}{2}$
    D. $\frac{2}{5}$

56. A number is chosen at random from the first 30 natural numbers. What is the probability that it is a perfect square?

    A. $\frac{1}{6}$
    B. $\frac{1}{5}$
    C. $\frac{1}{10}$
    D. $\frac{2}{15}$

57. Two dice are thrown. What is the probability that the difference of numbers shown is 2?

    A. $\frac{2}{9}$
    B. $\frac{1}{6}$
    C. $\frac{1}{9}$
    D. $\frac{7}{36}$

58. A bag contains 4 white, 5 black, and 6 red balls. Three balls are drawn at random. What is the probability that at least one is white?

    A. $\frac{37}{91}$
    B. $\frac{69}{91}$
    C. $\frac{54}{91}$
    D. $\frac{22}{91}$

59. If $P(A) = 0.3$, $P(B) = 0.4$, and A and B are independent, find $P(A' \cap B')$.

    A. 0.42
    B. 0.58
    C. 0.28
    D. 0.12

60. A letter is selected at random from the word "ARRANGEMENT". What is the probability that it is a consonant?

    A. $\frac{6}{11}$
    B. $\frac{5}{11}$
    C. $\frac{7}{11}$
    D. $\frac{4}{11}$

61. Three cards are drawn from a deck with replacement. What is the probability that all three are aces?

    A. $\frac{1}{2197}$
    B. $\frac{64}{140608}$
    C. $\frac{1}{169}$
    D. $\frac{8}{2197}$

62. A box contains 5 red, 4 blue, and 3 yellow marbles. Two marbles are drawn without replacement. What is the probability that the first is red and the second is blue?

    A. $\frac{5}{33}$
    B. $\frac{20}{132}$
    C. $\frac{10}{66}$
    D. $\frac{1}{6}$

63. A die is thrown twice. What is the probability that the product of the numbers is even?

    A. $\frac{3}{4}$
    B. $\frac{1}{2}$
    C. $\frac{5}{12}$
    D. $\frac{2}{3}$

64. From 10 boys and 8 girls, a committee of 5 is selected. What is the probability that it contains exactly 3 boys?

    A. $\frac{3360}{8568}$
    B. $\frac{1}{3}$
    C. $\frac{120}{357}$

D. $\frac{280}{714}$

65. A number is chosen at random from 1 to 60. What is the probability that it is divisible by 4 or 6?

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

B. $\frac{13}{30}$

C. $\frac{7}{15}$

D. $\frac{2}{5}$

66. Two events A and B are such that $P(A) = 0.5$, $P(B) = 0.6$, and $P(A \cap B) = 0.3$. Find $P(A|B)$.

A. 0.5

B. 0.6

C. 0.3

D. 0.8

67. A bag contains 7 red, 5 white, and 6 blue balls. If one ball is drawn at random, what is the probability that it is either red or white?

A. $\frac{2}{3}$

B. $\frac{7}{18}$

C. $\frac{5}{9}$

D. $\frac{12}{18}$

68. Four coins are tossed. What is the probability of getting at least two tails?

A. $\frac{11}{16}$

B. $\frac{5}{8}$

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

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

69. A number is selected at random from integers 1 to 25. What is the probability that it is prime?

A. $\frac{9}{25}$

B. $\frac{2}{5}$

C. $\frac{8}{25}$

D. $\frac{1}{3}$

70. Two dice are rolled. What is the probability that the sum is greater than 9?

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

B. $\frac{5}{36}$

C. $\frac{1}{4}$

D. $\frac{7}{36}$

71. A bag contains 6 identical red balls and 4 identical blue balls. If 3 balls are drawn at random, what is the probability of getting 2 red and 1 blue?

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

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

C. $\frac{2}{5}$

D. $\frac{60}{120}$

72. If events A and B are independent with $P(A) = 0.7$ and $P(B) = 0.5$, find $P(A \cup B)$.

A. 0.85

B. 0.9

C. 1.2

D. 0.35

73. A card is drawn from a deck. What is the probability that it is a red face card?

A. $\frac{3}{26}$

B. $\frac{1}{13}$

C. $\frac{6}{52}$

D. $\frac{1}{4}$

74. Three students attempt a problem independently. Their probabilities of solving it are $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{5}$. What is the probability that exactly one solves it?

A. $\frac{7}{15}$

B. $\frac{13}{30}$

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

D. $\frac{3}{10}$

75. A box contains 9 tickets numbered 1 to 9. Two tickets are drawn at random. What is the probability that the sum is even?

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

    B. $\frac{5}{9}$

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

    D. $\frac{20}{36}$

76. A die is rolled four times. What is the probability of getting at least one six?

    A. $\frac{671}{1296}$

    B. $\frac{625}{1296}$

    C. $\frac{2}{3}$

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

77. From a group of 6 men and 5 women, two people are selected at random. What is the probability that both are women?

    A. $\frac{2}{11}$

    B. $\frac{10}{55}$

    C. $\frac{5}{22}$

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

78. A bag contains 5 white and 7 black balls. If two balls are drawn at random with replacement, what is the probability that at least one is white?

    A. $\frac{95}{144}$

    B. $\frac{49}{144}$

    C. $\frac{5}{12}$

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

79. Two cards are drawn from a deck without replacement. What is the probability that the first is a king and the second is a queen?

    A. $\frac{4}{663}$

    B. $\frac{16}{2652}$

    C. $\frac{1}{169}$

    D. $\frac{8}{663}$

80. A number is chosen at random from 1 to 40. What is the probability that it is divisible by 2 and 3?

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

    B. $\frac{3}{20}$

    C. $\frac{7}{40}$

    D. $\frac{1}{5}$

81. Three dice are thrown simultaneously. What is the probability of getting the same number on all three?

    A. $\frac{1}{36}$

    B. $\frac{1}{216}$

    C. $\frac{6}{216}$

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

82. A bag contains 4 red, 3 blue, and 5 green marbles. Three marbles are drawn at random. What is the probability that no two are of the same color?

    A. $\frac{3}{11}$

    B. $\frac{60}{220}$

    C. $\frac{2}{11}$

    D. $\frac{30}{110}$

83. If $P(A) = 0.4$, $P(B) = 0.5$, and $P(A \cap B) = 0.2$, find $P(B|A)$.

    A. 0.5

    B. 0.4

    C. 0.2

    D. 0.25

84. A coin is biased such that heads is twice as likely as tails. What is the probability of getting tails?

    A. $\frac{1}{3}$

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

    C. $\frac{2}{3}$

D. $\frac{1}{4}$

85. A letter is chosen at random from the word "SUCCESS". What is the probability that it is the letter S?

A. $\frac{3}{7}$

B. $\frac{4}{7}$

C. $\frac{2}{7}$

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

86. Two dice are rolled. What is the probability that at least one die shows a number greater than 4?

A. $\frac{5}{9}$

B. $\frac{2}{3}$

C. $\frac{20}{36}$

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

87. A box contains 8 red, 6 blue, and 4 green balls. If three balls are drawn at random without replacement, what is the probability that all are blue?

A. $\frac{5}{204}$

B. $\frac{20}{816}$

C. $\frac{1}{34}$

D. $\frac{6}{204}$

88. If events A and B are mutually exclusive with $P(A) = 0.3$ and $P(B) = 0.5$, find $P(A' \cap B')$.

A. 0.2

B. 0.8

C. 0.35

D. 0.15

89. A number is selected at random from integers 10 to 30. What is the probability that it is divisible by 3?

A. $\frac{1}{3}$

B. $\frac{7}{21}$

C. $\frac{8}{21}$

D. $\frac{2}{7}$

90. Three cards are drawn from a deck without replacement. What is the probability that at least one is a spade?

A. $\frac{133}{204}$

B. $\frac{71}{204}$

C. $\frac{2}{3}$

D. $\frac{39}{68}$

91. A bag contains 10 balls numbered 1 to 10. If two balls are drawn at random, what is the probability that their product is odd?

A. $\frac{2}{9}$

B. $\frac{10}{45}$

C. $\frac{1}{3}$

D. $\frac{5}{18}$

92. A bag contains 7 red, 5 blue, and 3 yellow balls. If three balls are drawn at random without replacement, what is the probability that exactly two are red?

A. $\frac{21}{65}$

B. $\frac{168}{455}$

C. $\frac{42}{91}$

D. $\frac{3}{13}$

93. Two friends agree to meet between 2:00 PM and 3:00 PM. Each arrives at a random time and waits for 15 minutes. What is the probability that they meet?

A. $\frac{7}{16}$

B. $\frac{1}{4}$

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

D. $\frac{3}{8}$

94. Two events A and B are independent with $P(A) = 0.4$ and $P(A \cup B) = 0.7$. Find $P(B)$.

A. 0.5

B. 0.6

C. 0.3

D. 0.4

95. A die is rolled. What is the probability of getting a number less than 5?

A. $\frac{2}{3}$

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

C. $\frac{5}{6}$

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

96. From a deck of 52 cards, three cards are drawn with replacement. What is the probability that all three are kings?

A. $\frac{1}{2197}$

B. $\frac{64}{140608}$

C. $\frac{8}{2197}$

D. $\frac{1}{169}$

97. A box contains 5 red, 4 blue, and 6 green balls. Two balls are drawn without replacement. What is the probability that both are of the same color?

A. $\frac{16}{105}$

B. $\frac{31}{105}$

C. $\frac{1}{3}$

D. $\frac{37}{105}$

98. A coin is tossed 6 times. What is the probability of getting exactly 4 heads?

A. $\frac{15}{64}$

B. $\frac{5}{16}$

C. $\frac{3}{8}$

D. $\frac{1}{4}$

99. A number is chosen at random from 1 to 80. What is the probability that it is a multiple of both 4 and 6?

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

B. $\frac{3}{40}$

C. $\frac{7}{80}$

D. $\frac{1}{16}$

100. Two dice are thrown. What is the probability that the product of the numbers is a perfect square?

A. $\frac{1}{4}$

B. $\frac{11}{36}$

C. $\frac{7}{36}$

D. $\frac{5}{18}$

Chapter 6

Statistics

6.1 Measures of Central Tendency

6.1.1 Questions

1. Find the mean of the numbers 3, 5, 7, 9, and 11.

   A. 7

   B. 6

   C. 8

   D. 5

2. The median of the data set 2, 5, 8, 11, 14 is

   A. 8

   B. 5

   C. 11

   D. 7

3. Find the mode of the following data: 3, 5, 3, 7, 3, 9, 5.

   A. 3

   B. 5

   C. 7

   D. 9

4. The mean of five numbers is 12. If four of the numbers are 10, 11, 13, and 15, find the fifth number.

   A. 11

   B. 12

   C. 10

   D. 9

5. Find the median of 15, 20, 18, 12, 25, 22, 16.

   A. 18

   B. 20

   C. 16

   D. 19

6. The data set 4, 7, 7, 10, 10, 10, 13 has a mode of

   A. 10

   B. 7

   C. 13

   D. 4

7. If the mean of 8, 10, x, 14, and 16 is 12, find the value of x.

   A. 12

   B. 11

   C. 10

   D. 13

8. Find the mean of the first five prime numbers.

   A. 5.6

   B. 6

   C. 5

   D. 6.5

9. The median of 3, 7, 5, 9, 11, 13 is

   A. 8

   B. 7

   C. 9

   D. 7.5

10. Which measure of central tendency is most affected by extreme values?

    A. Mean

    B. Median

C. Mode

D. Range

11. Find the mode of 12, 15, 12, 18, 20, 12, 15, 18, 12.

A. 12

B. 15

C. 18

D. 20

12. The mean of 6, 8, 10, 12, and x is 10. Find x.

A. 14

B. 12

C. 10

D. 16

13. Find the median of 2, 4, 6, 8, 10, 12, 14, 16.

A. 8

B. 9

C. 10

D. 7

14. The ages of five students are 15, 16, 14, 17, and 18 years. Find their mean age.

A. 16

B. 15

C. 17

D. 14

15. If the mean of 7 numbers is 15 and the mean of 3 of them is 12, find the mean of the remaining 4 numbers.

A. 17.25

B. 16.5

C. 18

D. 15.75

16. Find the mode of the data: 5, 7, 5, 8, 5, 9, 7, 7, 5.

A. 5

B. 7

C. 8

D. 9

17. The median of 21, 15, 18, 12, 24, 27 is

A. 19.5

B. 18

C. 21

D. 20

18. Find the mean of 20, 25, 30, 35, 40.

A. 30

B. 25

C. 35

D. 28

19. The data set 2, 4, 6, 8 has no mode. What can be said about this data?

A. All values occur with equal frequency

B. The data is bimodal

C. The median is 5

D. Both A and C

20. If the mean of 5, 7, 9, x, and 11 is 8, find x.

A. 8

B. 7

C. 9

D. 6

21. Find the median of 40, 35, 50, 45, 30, 55, 60.

A. 45

B. 50

C. 40

D. 47.5

22. The mode of 3, 5, 7, 5, 9, 5, 11, 7 is

A. 5

B. 7

C. 9

D. 3

23. Calculate the mean of 12, 18, 24, 30, 36.

A. 24

B. 22

C. 26

D. 20

24. The median of an even number of observations is

A. The middle value

B. The average of the two middle values

C. The most frequent value

D. The sum of all values

25. Find the mean of the squares of the first four natural numbers.

A. 7.5

B. 10

C. 5

D. 8

26. If the mean of 10 numbers is 20 and one number 25 is removed, what is the new mean?

A. 19.44

B. 20

C. 18.5

D. 21

27. Find the mode of 8, 10, 12, 10, 8, 14, 10, 8, 10.

A. 10

B. 8

C. Both 8 and 10

D. 12

28. The median of 5, 10, 15, 20, 25, 30, 35, 40, 45 is

A. 25

B. 20

C. 30

D. 22.5

29. Find the mean of all multiples of 5 between 1 and 30.

A. 17.5

B. 15

C. 20

D. 12.5

30. The mean of 4, 6, 8, 10, 12 is increased by 3 when each number is increased by

A. 3

B. 15

C. 6

D. 9

31. Find the median of 100, 90, 80, 110, 120, 95, 105.

A. 100

B. 105

C. 95

D. 110

32. The mode of a data set with all different values is

A. Zero

B. Does not exist

C. The mean

D. The median

33. If the mean of x, x+2, x+4, x+6, and x+8 is 10, find x.

A. 6

B. 7

C. 8

D. 5

34. Find the median of 2.5, 3.5, 4.5, 5.5, 6.5, 7.5.

A. 5

B. 5.5

C. 4.5

D. 6

35. The mean of 15 observations is 32. If two observations 40 and 50 are added, what is the new mean?

A. 33.29

B. 34

C. 35

D. 32.5

36. Find the mode of 1, 2, 2, 3, 3, 3, 4, 4, 4, 4.

A. 4

B. 3

C. 2

D. 1

37. The median of 7, 14, 21, 28, 35 is

A. 21

B. 14

C. 28

D. 20

38. Calculate the mean of the first 10 even natural numbers.

A. 11

B. 10

C. 12

D. 9

39. If the mean of 20 observations is 15 and that of another 30 observations is 20, find the mean of all 50 observations.

A. 18

B. 17.5

C. 19

D. 16.5

40. Find the mode of the data where all frequencies are equal.

A. Does not exist

B. Zero

C. The mean

D. All values

41. The median of 1, 3, 5, 7, 9, 11, 13, 15, 17 is

A. 9

B. 8

C. 10

D. 7

42. Find the mean of 2.5, 3.0, 3.5, 4.0, 4.5, 5.0.

A. 3.75

B. 4

C. 3.5

D. 4.25

43. If the median of a data set is 25 and the mean is 30, the data is

A. Positively skewed

B. Negatively skewed

C. Symmetric

D. Normal

44. Find the mode of 50, 60, 70, 60, 80, 60, 90, 70.

A. 60

B. 70

C. 50

D. 80

45. The mean of three numbers is 20. If two of them are 15 and 18, find the third number.

A. 27

B. 25

C. 22

D. 20

46. Find the median of 0.5, 1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5.

A. 4

B. 3.5

C. 4.5

D. 5

47. The mode is most useful when data is

A. Categorical

B. Continuous

C. Symmetric

D. Normally distributed

48. Calculate the mean of 1, 4, 9, 16, 25.

A. 11

B. 10

C. 12

D. 13

49. If each observation in a data set is multiplied by 5, the mean is

A. Multiplied by 5

B. Divided by 5

C. Increased by 5

D. Remains the same

50. Find the median of 11, 22, 33, 44, 55, 66, 77, 88, 99.

A. 55

B. 44

C. 50

D. 60

51. The mean of 8 numbers is 25. If 5 is subtracted from each number, the new mean is

A. 20

B. 25

C. 30

D. 15

52. Find the mode of 15, 20, 25, 20, 30, 25, 20, 35.

A. 20

B. 25

C. 15

D. 30

53. The median of 6, 12, 18, 24, 30, 36 is

A. 21

B. 18

C. 24

D. 20

54. Find the mean of the first 7 odd natural numbers.

A. 7

B. 8

C. 6

D. 9

55. If the mean of 10, 15, 20, x, 30 is 20, find x.

A. 25

B. 20

C. 22

D. 18

56. The median is always

A. A value in the data set

B. The middle value when data is ordered

C. Equal to the mean

D. The most frequent value

57. Find the mode of 100, 200, 200, 300, 300, 300, 400.

A. 300

B. 200

C. 100

D. 400

58. The mean of 5 consecutive odd numbers is 21. Find the largest number.

A. 25

B. 23

C. 27

D. 21

59. Find the median of 50, 55, 60, 65, 70, 75, 80, 85, 90, 95.

A. 72.5

B. 70

C. 75

D. 65

60. Calculate the mean of 3, 6, 9, 12, 15, 18.

A. 10.5

B. 12

C. 9

D. 11

61. The mode of a bimodal distribution has

A. Two values

B. One value

C. Three values

D. No value

62. If the mean of x, 2x, 3x, 4x, and 5x is 30, find x.

A. 10

B. 5

C. 15

D. 20

63. Find the median of 17, 23, 19, 21, 25, 20, 22.

A. 21

B. 20

C. 22

D. 19

64. The mean of 12 observations is 15. If each observation is doubled, the new mean is

A. 30

B. 15

C. 27

D. 18

65. Find the mode of 2, 4, 6, 2, 8, 2, 10, 4, 6, 2.

A. 2

B. 4

C. 6

D. 8

66. The median of 9, 18, 27, 36, 45, 54, 63, 72 is

A. 40.5

B. 36

C. 45

D. 42

67. Find the mean of all two-digit multiples of 10.

A. 55

B. 50

C. 60

D. 45

68. If the mean of a, b, c is 15 and the mean of a, b, c, d is 20, find d.

A. 35

B. 30

C. 25

D. 40

69. Find the median of integers from 1 to 9.

A. 5
B. 4
C. 6
D. 4.5

70. The mode of the data 5, 10, 15, 10, 20, 15, 10, 25 is

A. 10
B. 15
C. 20
D. 5

71. Calculate the mean of 0, 5, 10, 15, 20, 25, 30.

A. 15
B. 12.5
C. 17.5
D. 20

72. If every value in a data set is the same, then

A. Mean = Median = Mode
B. Mean ≠ Median
C. Mode does not exist
D. Median ≠ Mode

73. Find the median of 1.2, 3.4, 2.3, 4.5, 3.2, 5.1.

A. 3.3
B. 3.4
C. 3.2
D. 2.85

74. The mean of 6 numbers is 18. If one number 24 is replaced by 18, the new mean is

A. 17
B. 18
C. 19
D. 16

75. Find the mode of 7, 14, 21, 14, 28, 21, 14, 35.

A. 14
B. 21
C. 7
D. 28

76. The median of 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11 is

A. 6
B. 5
C. 7
D. 5.5

77. Find the mean of 16, 18, 20, 22, 24, 26, 28.

A. 22
B. 20
C. 24
D. 21

78. If the median is greater than the mean, the data is likely

A. Negatively skewed
B. Positively skewed
C. Symmetric
D. Uniform

79. Find the mode of 33, 44, 55, 44, 66, 55, 44, 77.

A. 44
B. 55
C. 33
D. 66

80. The mean of the first n natural numbers is

A. $\frac{n+1}{2}$
B. $\frac{n}{2}$
C. $n+1$
D. $\frac{n-1}{2}$

81. Find the median of 5, 15, 25, 35, 45, 55, 65, 75, 85.

A. 45
B. 40
C. 50
D. 35

82. Calculate the mean of 7, 14, 21, 28, 35, 42.

A. 24.5
B. 21
C. 28
D. 25

83. The mode is preferred over the mean when

A. Data is qualitative
B. Data has extreme values

C. Quick calculation is needed

D. All of the above

84. Find the median of 8, 16, 24, 32, 40, 48, 56.

A. 32

B. 28

C. 36

D. 24

85. If the mean of 4, 8, 12, x, 20 is 12, find x.

A. 16

B. 14

C. 12

D. 18

86. The median of 3, 6, 9, 12, 15, 18, 21, 24, 27, 30 is

A. 16.5

B. 15

C. 18

D. 15.5

87. Find the mean of 2, 4, 8, 16, 32.

A. 12.4

B. 10

C. 14

D. 16

88. Which measure of central tendency can have more than one value?

A. Mode

B. Mean

C. Median

D. None

89. Find the median of 13, 26, 39, 52, 65, 78, 91.

A. 52

B. 39

C. 45.5

D. 65

90. The mean of 5 consecutive even numbers is 16. Find the smallest number.

A. 12

B. 10

C. 14

D. 16

91. Find the mode of 1, 3, 5, 3, 7, 5, 9, 5, 11.

A. 5

B. 3

C. 7

D. 1

92. The median is less affected by outliers than the mean because it

A. Depends only on position

B. Is always smaller

C. Is always larger

D. Uses all data values

93. Find the mean of 11, 22, 33, 44, 55, 66, 77, 88, 99.

A. 55

B. 50

C. 60

D. 44

94. The sum of deviations of observations from their mean is always

A. Zero

B. Positive

C. Negative

D. One

95. The mean of 9 numbers is 40. If 4 is added to each number, the new mean is

A. 44

B. 40

C. 36

D. 45

96. Find the median of 1.5, 2.5, 3.5, 4.5, 5.5, 6.5, 7.5, 8.5.

A. 5

B. 4.5

C. 5.5

D. 6

97. For a symmetric distribution, which relationship holds?

A. Mean = Median = Mode

B. Mean > Median

C. Median > Mean

D. Mode > Mean

98. If each value in a data set is increased by k, the mean increases by

    A. k
    B. $2k$
    C. k^2
    D. $\frac{k}{n}$

99. The mode of a trimodal distribution has

    A. Three values
    B. Two values
    C. One value
    D. No value

100. The median divides the data into

    A. Two equal parts
    B. Three equal parts
    C. Four equal parts
    D. Unequal parts

Chapter 7

Values To Memorize

7.1 Square Roots

- $\sqrt{1} = 1$
- $\sqrt{2} = 1.4142$
- $\sqrt{3} = 1.7321$
- $\sqrt{4} = 2$
- $\sqrt{5} = 2.2361$
- $\sqrt{6} = 2.4495$
- $\sqrt{7} = 2.6458$
- $\sqrt{8} = 2.8284$
- $\sqrt{9} = 3$
- $\sqrt{10} = 3.1623$

7.2 Squares

- $1^2 = 1$
- $2^2 = 4$
- $3^2 = 9$
- $4^2 = 16$
- $5^2 = 25$
- $6^2 = 36$
- $7^2 = 49$
- $8^2 = 64$
- $9^2 = 81$
- $10^2 = 100$
- $11^2 = 121$
- $12^2 = 144$
- $13^2 = 169$
- $14^2 = 196$
- $15^2 = 225$
- $16^2 = 256$
- $17^2 = 289$
- $18^2 = 324$
- $19^2 = 361$
- $20^2 = 400$
- $21^2 = 441$
- $22^2 = 484$
- $23^2 = 529$
- $24^2 = 576$
- $25^2 = 625$
- $26^2 = 676$
- $27^2 = 729$
- $28^2 = 784$
- $29^2 = 841$
- $30^2 = 900$

7.3 Cubes

- $1^3 = 1$
- $2^3 = 8$
- $3^3 = 27$
- $4^3 = 64$
- $5^3 = 125$
- $6^3 = 216$
- $7^3 = 343$
- $8^3 = 512$
- $9^3 = 729$
- $10^3 = 1000$
- $11^3 = 1331$
- $12^3 = 1728$
- $13^3 = 2197$
- $14^3 = 2744$
- $15^3 = 3375$
- $16^3 = 4096$
- $17^3 = 4913$
- $18^3 = 5832$
- $19^3 = 6859$
- $20^3 = 8000$
- $21^3 = 9261$
- $22^3 = 10648$
- $23^3 = 12167$
- $24^3 = 13824$
- $25^3 = 15625$
- $26^3 = 17576$
- $27^3 = 19683$
- $28^3 = 21952$
- $29^3 = 24389$
- $30^3 = 27000$

7.4 Logarithms

- $\log_{10} 1 = 0$
- $\log_{10} 2 = 0.3010$
- $\log_{10} 3 = 0.4771$
- $\log_{10} 4 = 0.6020$
- $\log_{10} 5 = 0.699$
- $\log_{10} 6 = 0.778$
- $\log_{10} 7 = 0.845$
- $\log_{10} 8 = 0.903$
- $\log_{10} 9 = 0.954$
- $\log_{10} 10 = 1$