Grade 9


## CREST Mental Maths Olympiad (CMMO) Sample Paper

Pattern and Marking Scheme

| Grade | Topic/Section | No. of <br> Questions | Marks per <br> Question | Total <br> Marks |
| :--- | :--- | :--- | :--- | :--- |
| Grade 9 | Basique | 80 | 3 | 240 |
|  | Avance | 20 | 6 | 120 |
| Grand Total |  | $\mathbf{1 0 0}$ |  | $\mathbf{3 6 0}$ |

The total duration of the exam is 60 minutes.
Note: For every incorrect answer, there's a penalty of $1 / 3$ rd of the total marks allotted to that question.

## Syllabus

## Number System

a. Integers and rational numbers
b. Simplification

## Algebra

a. Polynomials
b. Quadratic equations

## Comparing Quantities

a. Time and distance
b. Simple interest
c. Compound interest
d. Profit and loss
e. Problems on ages
f. Time and work
g. Boats and streams
h. Average and Percentage
i. Partnership
j. Ratio and proportion

## Geometry

a. Lines and angles

## Mensuration

a. Surface area of cube
b. Surface area of cuboid
c. Surface area of cylinder
d. Surface area of cone, etc.
e. Volume of cube
f. Volume of cuboid
g. Volume of cylinder
h. Volume of cone, etc.
i. Heights and distance
j. Area of a quadrilateral, Area of triangle \& Area related to circles

## Playing with Numbers

a. Number series
b. Alphanumeric series
c. Tests of divisibility
d. Exponents
e. Factorisation

## Data Handling

a. Statistics
b. Probability
c. Data interpretation

For more details visit: https://www.crestolympiads.com/mental-maths-mmo

## Basique (Each Question is 3 Marks)

1. Express 3.14 into mixed fraction.
a. $3 \frac{27}{99}$
b. $3 \frac{11}{99}$
C. $3 \frac{14}{99}$
d. $6 \frac{9}{99}$
2. Find the value of $(125)^{2 / 9}$.
a. $\sqrt[3]{2} 25$
b. 25
c. $\sqrt{ } 5$
d. ${ }^{3} \sqrt{5}$
3. Find the result of subtracting the sum of all integers between 10 and 20 from the sum of all integers from 10 to 20.
a. 40
b. 46
c. 32
d. 30
4. Express 2.7777 $\qquad$ in the form of $p / q$.
a. 29/9
b. $23 / 9$
c. $25 / 9$
d. $21 / 9$
5. Which of the following is a non-terminating decimal?
a. $65 / 100$
b. $2 / 9$
c. $32 / 10$
d. $66 / 8$
6. What is the decimal representation of $1 / 3$ ?
a. 0.3
b. 0.33
c. 0.333
d. $0 . \overline{333}$
7. What is the coefficient of $x^{2}$ in the polynomial $P(x)=3 x^{3}+10\left(x-x^{2}\right)-5 x^{2}-2$ ?
a. -14
b. -15
c. -12
d. -19
8. What is the product of Zero's polynomials $(x+8)(x-10)$ ?
a. -80
b. -45
c. -76
d. -95
9. What are the two roots of the equation $(x+4)(x-5)=0$ ?
a. 4,5
b. 6,4
c. $-4,5$
d. $-6,4$
10. Find two values of $x$ which satisfy the quadratic equation $x^{2}-64=0$ ?
a. 64
b. 16
c. $\pm 12$
d. $\pm 8$
11. What are the two roots of the equation $(x+5)^{2}-36=0$ ?
a. $1,-11$
b. 2,15
c. $-7,3$
d. $8,-9$
12. Sum of the two numbers is 273 . If first number is $2 / 5$ of the second number. Find the second number.
a. 158
b. 195
c. 187
d. 221
13. A man travelled a certain distance by train at a rate of $15 \mathrm{~km} / \mathrm{h}$ and walked back at the rate of $12 \mathrm{~km} / \mathrm{h}$. The whole journey took 9 hours. Find the distance he travelled.
a. 60 km
b. 40 km
c. 58 km
d. 72 km
14. Walking $4 / 5$ of his usual speed, a man is 16 minutes late. Find the usual time taken by him to cover that distance.
a. 48 min
b. 37 min
c. 64 min
d. 84 min
15. A person takes 20 h to travel a certain distance. If his speed is increased by $25 \%$, then what time will he take to travel the same distance?
a. 20 hrs
b. 16 hrs
c. 11 hrs
d. 18 hrs
16. A sum of money becomes four times in 20 years at simple interest. Find the rate of interest.
a. $22 \%$
b. $23 \%$
c. $15 \%$
d. $8 \%$
17. A sum of $\$ 7700$ is lent out in two parts in such a way that the interest on one part at $20 \%$ for 5 years is equal to that on another part at $9 \%$ for 6 years. Find the second part of the sum.
a. $\$ 5,000$
b. $\$ 2,349$
c. $\$ 5,689$
d. $\$ 4,698$
18. If the cost price of an article is $\$ 300$ and the per cent markup is $30 \%$. What is the marked price?
a. $\$ 470$
b. $\$ 390$
c. $\$ 380$
d. $\$ 420$
19. A shopkeeper expects a profit of $50 \%$ on his cost price. In a week, his sale was $\$ 15000$. What was his profit?
a. $\$ 5,000$
b. $\$ 15,000$
c. $\$ 6,870$
d. $\$ 9,790$
20. Five years ago, the average age of $P$ and $Q$ was 15 years. Now, average age of $P, Q$ and $R$ is 20 years. What would be the age of $R$ after 10 years?
a. 20 years
b. 30 years
c. 15 years
d. 45 years
21. Jack is 15 years elder than Richard. If 5 years ago, Jack was 3 times as old as Richard, then find Jack's present age.
a. 30 years
b. 25 years
c. 20 years
d. 10 years
22. The ratio of the present ages of Peter and Tom is $8: 7$. Five years ago, the ratio of their ages was $3: 2$. Find the present age of Peter.
a. 8 years
b. 9 years
c. 11 years
d. 16 years
23. Two pipes can fill a tank in 18 min and 24 min, respectively. Both are opened simultaneously. After how many minutes should the first pipe be closed so that the tank becomes full in 16 min?
a. 8
b. 7
c. 9
d. 6
24. Either 8 men or 17 women can paint a wall in 33 days. Find the number of days required to paint three such walls by 12 men and 24 women working at the same rate.
a. 21 days
b. 18 days
c. 34 days
d. 27 days
25. A man rows with a speed of $8 \mathrm{~km} / \mathrm{h}$ in still water. Find the downstream, if the speed of the stream is $4 \mathrm{~km} / \mathrm{h}$.
a. $16 \mathrm{~km} / \mathrm{h}$
b. $18 \mathrm{~km} / \mathrm{h}$
c. $14 \mathrm{~km} / \mathrm{h}$
d. $12 \mathrm{~km} / \mathrm{h}$
26. A boat can cover 48 km downstream in 3 h . It can cover 40 km upstream in 4 h . What is the speed of the boat in still water (in $\mathrm{km} / \mathrm{h}$ )?
a. $13 \mathrm{~km} / \mathrm{h}$
b. $15 \mathrm{~km} / \mathrm{h}$
c. $14 \mathrm{~km} / \mathrm{h}$
d. $12 \mathrm{~km} / \mathrm{h}$
27. A fruit seller bought a basket containing 2050 oranges out of which 41 oranges were rotten. What percentage of oranges were rotten?
a. $6 \%$
b. $7 \%$
c. $2 \%$
d. $3 \%$
28. The population of the town is 352800 . If it increases at the rate of $5 \%$ per annum, then what will be its population for 2 years hence? Also, find the population 2 years ago.
a. 336757
b. 388962
c. 367565
d. 347688
29. In a school, the average age of students is 6 years, and the average age of 12 teachers is 40 years. If the average age of the combined group of all the teachers and students is 7 years, then the number of students is:
a. 153
b. 323
c. 214
d. 396
30. Rexon and Sam started a business initially with $\$ 14200$ and $\$ 15600$, respectively. If total profits at the end of year are $\$ 74500$, what is Rexon's share in the profit?
a. $\$ 35,500$
b. $\$ 28,800$
c. $\$ 21,980$
d. $\$ 38,920$
31. A starts a business with $\$ 24,000 /-$ and later $B$ joins him with $\$ 48,000$. After how many months did $B$ join if the profit is distributed in an equal ratio?
a. 5
b. 4
c. 6
d. 8
32. A shopkeeper marks his goods $20 \%$ above C.P. but allows a $30 \%$ discount for cash. What is his net loss?
a. $20 \%$
b. $17 \%$
c. $13 \%$
d. $16 \%$
33. A single discount, equivalent to a successive discount of $40 \%$ and $30 \%$ is:
a. $37 \%$
b. $58 \%$
c. $52 \%$
d. $38 \%$
34. What is the measure of the angle if its supplementary angle measures $98^{\circ}$ ?
a. $82^{\circ}$
b. $78^{\circ}$
c. $88^{\circ}$
d. $98^{\circ}$
35. In a $\triangle P Q R, P S=S R=S Q$ and $\angle P R S=55^{\circ}$. Find $\angle S Q P$.

a. $25^{\circ}$
b. $55^{\circ}$
c. $35^{\circ}$
d. $45^{\circ}$
36. Angles of a linear pair are in the ratio $8: 1$. What is the degree of measure of both angles?
a. $90^{\circ}$ and $230^{\circ}$
b. $160^{\circ}$ and $20^{\circ}$
c. $80^{\circ}$ and $40^{\circ}$
d. $110^{\circ}$ and $40^{\circ}$
37. $\triangle \mathrm{ABC}$ and $\triangle \mathrm{DEC}$ are the right triangles with $\angle B=\angle E=90^{\circ}$, find $B E$.

a. 20 cm
b. 18 cm
c. 11 cm
d. 15 cm
38. In the given figure, $P Q=P R=P S$. Find $\angle Q R S$.

a. $49^{\circ}$
b. $90^{\circ}$
c. $76^{\circ}$
d. $110^{\circ}$
39. An equilateral triangle is cut up into smaller equilateral triangles with sides $1 / 6$ of the original. Find the number of triangles thus formed.
a. 43
b. 29
c. 36
d. 20
40. Find x in the given figure:

a. $130^{\circ}$
b. $135^{\circ}$
c. $142^{\circ}$
d. $145^{\circ}$
41. In the figure given below, find the area of the parallelogram.

a. $245 \mathrm{~cm}^{2}$
b. $212 \mathrm{~cm}^{2}$
c. $225 \mathrm{~cm}^{2}$
d. $255 \mathrm{~cm}^{2}$
42. How many tangents are there in all in this figure?

a. 2
b. 0
c. 4
d. 1
43. What is the type of angle formed in a Minor segment of a circle?
a. Straight angle
b. Complete angle
c. Obtuse angle
d. Right angle
44. If a square is inscribed in a circle, find the ratio of the area of the circle and the square.
a. $\pi: 2$
b. $\pi: 1$
c. $2: 1$
d. $2: 5$
45. If $a=12 \mathrm{~cm}, \mathrm{~b}=13 \mathrm{~cm}, \mathrm{c}=15 \mathrm{~cm}$, what is the semi-perimeter of the triangle?
a. 16 cm
b. 22 cm
c. 26 cm
d. 20 cm
46. Find the area of a triangle whose two sides are 16 cm and 12 cm respectively and the perimeter is 42 cm .
a. $21 \sqrt{ } 5$
b. $7 \sqrt{ } 21$
c. $21 \sqrt{ } 15$
d. $7 \sqrt{ } 3$
47. A bicycle wheel makes 10 revolutions in moving 880 m . Find the diameter of the wheel. ( $\pi=$ 22/7)
a. 32 cm
b. 36 cm
c. 40 cm
d. 28 cm
48. Two-circle touch internally. The sum of their area is $116 \mathrm{~m} \mathrm{~cm}^{2}$ and distance between their centre is 6 cm . Then, what are the radii of the circles?
a. $10 \mathrm{~cm}, 4 \mathrm{~cm}$
b. $15 \mathrm{~cm}, 6 \mathrm{~cm}$
c. $12 \mathrm{~cm}, 8 \mathrm{~cm}$
d. $16 \mathrm{~cm}, 6 \mathrm{~cm}$
49. What will be the area of a circle with a circumference equal to 88 cm ?
a. $512 \mathrm{~cm}^{2}$
b. $622 \mathrm{~cm}^{2}$
c. $616 \mathrm{~cm}^{2}$
d. $578 \mathrm{~cm}^{2}$
50. What will be the volume of tank whose length is 10 m , breadth 8 m and height 6 m ?
a. $540 \mathrm{~m}^{3}$
b. $480 \mathrm{~m}^{3}$
c. $370 \mathrm{~m}^{3}$
d. $520 \mathrm{~m}^{3}$
51. An underground water tank is in the shape of a cube of side 7 m . What will be its volume?
a. $343 \mathrm{~m}^{3}$
b. $535 \mathrm{~m}^{3}$
c. $245 \mathrm{~m}^{3}$
d. $143 \mathrm{~m}^{3}$
52. What is the number of solid spheres of radius $1 / 2 \mathrm{~cm}$, which may be formed from a solid sphere of radius 2 cm ?
a. 45
b. 56
c. 34
d. 64
53. The base radius of a cylinder is 20 cm and its height is 10 cm . Find its curved surface area in $\mathrm{cm}^{2}$.
a. $1180 \mathrm{~cm}^{2}$
b. $1280 \mathrm{~cm}^{2}$
c. $1260 \mathrm{~cm}^{2}$
d. $1200 \mathrm{~cm}^{2}$
54. Find curved and total surface area of a conical flask of radius 6 cm and height 8 cm .
a. $60 \pi, 96 \pi$
b. $86 \pi, 66 \pi$
c. $47 \pi, 53 \pi$
d. $37 \pi, 76 \pi$
55. The angle of elevation of the top of a tower from a point on the ground, which is 60 m away from the foot of the tower, is $30^{\circ}$. Find the height of the tower.
a. $10 \sqrt{ } 3$
b. $60 \sqrt{ } 3$
c. $2 \sqrt{ } 3$
d. $20 \sqrt{ } 3$
56. An observer 1.5 m tall is 37.5 m away from a chimney. The angle of elevation of the top of the chimney from her eyes is $45^{\circ}$. What is the height of the chimney?
a. 39 m
b. 32 m
c. 28 m
d. 31 m
57. Find the next number in the sequence:
$1,1,2,3,5,8,13$, ?
a. 15
b. 17
c. 19
d. 21
58. Solve: $3 / 5$ th of $24 \%$ of $500-32=$ ?
a. 38
b. 40
c. 64
d. 48
59. Solve:
$1601 \times 198 \div 49-1399+3878=$ ?
a. 6000
b. 8700
c. 8900
d. 4700
60. Solve:
$2 \times 256 \times ?=82 \times 102 \times 2$
a. 25
b. 43
c. 65
d. 37
61. How many such vowels are there in the below arrangement each of which is immediately preceded by a consonant and immediately followed by a number?
P\%R15H*MTE3B\$VN4KA8WI62G\#UH7JQ11LY
a. 2
b. 3
c. 1
d. 4
62. Which of the following digit will be sixth to the left of tenth from the right end?

1125472845719652414582439769429
a. 1
b. 3
c. 2
d. 5
63. If in each number, first and last digits are interchanged, which of the following will be the highest number? 147831389425598
a. 425
b. 598
c. 831
d. 389
64. Which number is divisible by 18 ? 383893, 238768, 926568, 273638
a. 273638
b. 238768
c. 926568
d. 383893
65. If the number 87215 X 6 is completely divisible by 11 , then the smallest whole number in place of $X$.
a. 3
b. 2
c. 5
d. 4
66. Which number is divisible by 17 ? 665213, 324256, 648723, 957508
a. 957508
b. 648723
c. 324256
d. 665213
67. What is the mean of the test score for a class of students whose scores are $86,94,70,81$, $92,74,75,89,76$ and 97 ?
a. 83.4
b. 84.6
c. 86
d. 86.4
68. What is the value of $x$, if the median of the following data is 27.5 ? $24,25,26, x+2, x+3,30,33,37$
a. 23
b. 25
c. 27
d. 29
69. Study the graph carefully and answer the question.

The bar graph gives the number of products manufactured and sold by a company over the years (in thousands).
What is the difference in the number of products sold by the company in the year 2022 and 2017?

a. 26000
b. 25000
c. 35500
d. 15000
70. The graph shows the percentage break-up of sales of units of different products in 2018. Find out the difference between the product $A$ and $C$ together and product $B$ and $D$ together?

a. 10
b. 30
c. 15
d. 25
71. Study the line graph and find the number of vehicles manufactured by company X in 2022.

a. 120000
b. 140000
c. 160000
d. 100000
72. The graph below shows the profit earned by three companies over the years (in $\$ 10$ million ) What was the average profit earned by all three companies in the year 2021?

a. $\$ 4$ billion
b. $\$ 3$ billion
c. $\$ 2$ billion
d. $\$ 8$ billion
73. A coin is tossed twice. Find the probability of getting both tails.
a. $1 / 3$
b. $1 / 2$
c. $1 / 4$
d. $3 / 5$
74. A coin is tossed once, find the probability of getting 'Head'.
a. $2 / 4$
b. $4 / 6$
c. $1 / 4$
d. $1 / 2$
75. In a pack of 52 cards, what is the probability of getting a face card?
a. $4 / 13$
b. $4 / 9$
c. $3 / 13$
d. $3 / 8$
76. Study the pie-chart carefully to answer the question:

What was the approximate average number of passengers in Train-S, Train-M and Train-L together?

a. 1467
b. 1671
c. 1355
d. 1456
77. Study the following table to answer the given question?

In City E, a number of Specialist officers is approximately what percent of that officer?

| Center/Post | Officer | Clerk | Field <br> Officer | Supervisor | Specialist |
| :---: | :---: | :---: | :---: | :---: | :---: |
| City A | 2000 | 5000 | 50 | 2050 | 750 |
| City B | 15000 | 17000 | 160 | 11000 | 750 |
| City C | 17000 | 19500 | 70 | 7000 | 900 |
| City D | 3500 | 20000 | 300 | 90000 | 1150 |
| City E | 14900 | 17650 | 70 | 1300 | 1200 |
| City F | 11360 | 15300 | 30 | 1500 | 650 |
| City G | 9000 | 11000 | 95 | 1650 | 500 |

a. $8 \%$
b. $7 \%$
c. $4 \%$
d. $2 \%$
78. A class consists of 4 students and the marks obtained by them in Physics, Chemistry, Mathematics are given in the following table.
Study the table carefully and answer the question.
Find the average score in Physics by the students in the class.

| Students $\rightarrow$ <br> Subjects $\downarrow$ | $\mathrm{S}_{1}$ | $\mathrm{~S}_{2}$ | $\mathrm{~S}_{3}$ | $\mathrm{~S}_{4}$ |
| :--- | :---: | :---: | :---: | :---: |
| Physics | 60 | 50 | 70 | 75 |
| Chemistry | 70 | 45 | 60 | 80 |
| Mathematics | 80 | 55 | 55 | 75 |

a. $45 \frac{4}{7}$ marks
b. $37 \frac{6}{13}$ marks
c. $63 \frac{3}{4}$ marks
d. $83 \frac{7}{9}$ marks
79. Solve:
$(16 \times 64)+3^{3}$
a. 994
b. 1001
c. 1051
d. 1130
80. Factorise:

$$
\left(x^{2}-x\right)^{2}-8\left(x^{2}-x\right)+12
$$

a. $(x-1)(x-2)(x+1)(x+2)$
b. $(x+2)(x-2)(x-2)(x+3)$
c. $(x-1)(x-2)(x-3)(x-2)$
d. $(x+1)(x-2)(x-3)(x+2)$

## Avance (Each Question is 6 Marks)

81. What is the value of $(625)^{0.24} \mathrm{X}(625)^{0.01}$ ?
a. 4
b. 5
c. 25
d. 16
82. Write the decimal expansion of the following number which have terminating decimal expansion:
8/5
a. 1.6
b. 1.2657
c. 1.676767.....
d. 1.868686
83. Solve the following equation.
$x+2=\frac{2 x-8}{x+5}-\frac{5 x+9}{x+5}$
a. $x^{2}+7 x+10=0$
b. $x^{2}+10 x+27=0$
c. $x^{2}+7 x+4 x+10=0$
d. $3 x^{2}+3 x+17=0$
84. Robert invested an amount of $\$ 10000$ at compound interest rate of $10 \%$ per annum for a period of three years. How much amount will Robert get after 3 years?
a. $\$ 12,709$
b. $\$ 46,912$
c. $\$ 15,498$
d. $\$ 13,310$
85. The cost of an article including the sales tax is $\$ 616$. The rate of sales tax is $10 \%$, if the shopkeeper has made a profit of $12 \%$, then find the cost price of the article.
a. $\$ 128$
b. $\$ 400$
c. $\$ 880$
d. $\$ 500$
86. A man can row $14 \mathrm{~km} / \mathrm{h}$ in still water. When the stream is running at $2 \mathrm{~km} / \mathrm{h}$, it takes him 7 hours to row to a place and to come back. How far is the place?
a. 27 km
b. 48 km
c. 38 km
d. 39 km
87. A starts a business with $\$ 4000$ and $B$ joins him after 3 months with $\$ 16000$. Find the ratio of their profits at the end of year.
a. 1:1
b. $3: 7$
c. $2: 5$
d. $1: 3$
88. The marked price on an item was $\$ 3000$ but the shopkeeper offered a double discount of $30 \%$ and $20 \%$. How much did he finally sell the item?
a. $\$ 1,680$
b. $\$ 1,430$
c. $\$ 1,270$
d. $\$ 1,580$
89. In the given figure, $\angle \mathrm{DAC}=30^{\circ}, \angle \mathrm{CBD}=40^{\circ}, \angle \mathrm{ADB}=\mathrm{y}^{\circ}$ and $\angle \mathrm{ACB}=\mathrm{x}^{\circ}$. Find the difference between angles $\mathrm{y}^{\circ}$ and $\mathrm{x}^{\circ}$.

a. $65^{\circ}$
b. $70^{\circ}$
c. $80^{\circ}$
d. $45^{\circ}$
90. In the given figure, PQRS is a rectangle. Find PR + QS.

a. 32 cm
b. 26 cm
c. 44 cm
d. 36 cm
91. In the given figure, ' $O$ ' is the centre of the circle and $\angle A O C=160^{\circ}$. What is the measure of $\angle A B C$ ?

a. $76^{\circ}$
b. $80^{\circ}$
c. $160^{\circ}$
d. $90^{\circ}$
92. Find the area of the triangular field of sides $55 \mathrm{~m}, 60 \mathrm{~m}$ and 65 m . Also, find the cost of laying the grass in the triangular field at the rate of $\$ 12$ per $\mathrm{m}^{2}$.
a. $1525.5 \mathrm{~m}^{2}, \$ 15,354$
b. $1537.5 \mathrm{~m}^{2}, \$ 18,444$
c. $1500.5 \mathrm{~m}^{2}, \$ 17,278$
d. $1480.5 \mathrm{~m}^{2}, \$ 18,669$
93. Three metal cubes with edges $6 \mathrm{~cm}, 8 \mathrm{~cm}$ and 10 cm respectively are melted together and formed into a single cube. Find the side of the resulting cube.
a. 11 cm
b. 12 cm
c. 15 cm
d. 17 cm
94. From the top of a 5 m high building, the angle of elevation of the top of a cable tower is $60^{\circ}$ and the angle of depression of its foot is $45^{\circ}$. Determine the height of the tower.
a. $7(\sqrt{ } 3+1) \mathrm{m}$
b. $5(\sqrt{ } 2+1) \mathrm{m}$
c. $7(\sqrt{ } 2+1) m$
d. $5(\sqrt{3}+1) \mathrm{m}$
95. If $x$ and $y$ are the two digits of the number $883 x y$ such that this number is divisible by 80 , then $x+y=$ ?
a. 4
b. 5
c. 2
d. 6
96. The mean of 11 observations is 50 . If the mean of first Six observations is 49 and that of last six observations is 52 , then find sixth observation.
a. 56
b. 58
c. 60
d. 62
97. Evaluate:
$\left(2^{6} \div 2^{3}\right)^{-1 / 3}$
a. 1
b. $2 / 3$
c. $1 / 2$
d. $1 / 3$
98. Study the information carefully and answer the question given beside.

Out of 200 people who attended an office party 100 had Ice-cream, 120 had cold drink, 80 had cake and 10 had none of these three. 100 people had exactly one of three items. How many people had exactly two of the three items?
a. 80
b. 90
c. 70
d. 65
99. The graph shows the percentage net profit of a certain company during the given period.

Study it carefully and answer the question.
During which years the ratio of percentage net profit earned to that in the previous year was the minimum?

a. 2017
b. 2022
c. 2019
d. 2020
100. Factorise:
$x^{4}-2 x^{2} y^{2}+y^{4}$
a. $(y)(x+y)(x+y)(2 x)$
b. $(2 x+y)(x-y)(x+y)(2 x)$
c. $(2 x+y)(x+y)(x-y)(2 x-y)$
d. $(x-y)(x+y)(x-y)(x+y)$

## Answer Key

| 1. | c | 2. | a | 3. | d | 4. | c | 5. | b | 6. | d | 7. | b |
| :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- | :--- |
| 8. | a | 9. | c | 10. | d | 11. | a | 12. | b | 13. | a | 14. | c |
| 15. | d | 16. | c | 17. | a | 18. | b | 19. | a | 20. | b | 21. | c |
| 22. | a | 23. | d | 24. | c | 25. | d | 26. | a | 27. | c | 28. | b |
| 29. | d | 30. | a | 31. | c | 32. | d | 33. | b | 34. | a | 35. | c |
| 36. | b | 37. | d | 38. | b | 39. | c | 40. | a | 41. | c | 42. | d |
| 43. | c | 44. | a | 45. | d | 46. | c | 47. | d | 48. | a | 49. | c |
| 50. | b | 51. | a | 52. | d | 53. | c | 54. | a | 55. | d | 56. | a |
| 57. | d | 58. | b | 59. | c | 60. | a | 61. | b | 62. | c | 63. | d |
| 64. | c | 65. | b | 66. | a | 67. | a | 68. | b | 69. | b | 70. | a |
| 71. | c | 72. | a | 73. | c | 74. | d | 75. | c | 76. | b | 77. | a |
| 78. | c | 79. | c | 80. | d | 81. | b | 82. | a | 83. | b | 84. | d |
| 85. | d | 86. | b | 87. | d | 88. | a | 89. | b | 90. | b | 91. | b |
| 92. | b | 93. | b | 94. | d | 95. | c | 96. | a | 97. | c | 98. | c |
| 99. | a | 100. | d |  |  |  |  |  |  |  |  |  |  |

