SAINIK SCHOOL AMBIKAPUR

SUMMER VACATION HOMEWORK (2025-26)

"Dear Cadets, Have a wonderful vacation with joy, enthusiasm and Happy Learning"

Class IX

Do the following by cutting and pasting activities

1. To construct a square-root spiral.
2. To verify the algebraic identity : $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$.
3. To verify the algebraic identity : $(a+b)^3 = a^3 + b^3 + 3a^2 b + 3ab^2$
4. To verify experimentally that if two lines intersect, then (i) the vertically opposite angles are equal (ii) the sum of two adjacent angles is 180^o (iii) the sum of all the four angles is 360^o.
5. To verify experimentally that the sum of the angles of a quadrilateral is 360^o.
6. Solve 50 MCQ's of each chapter (Number System, and Polynomials) and solve Exercise questions from NCERT book.

MCQ WORKSHEET-II
CLASS IX : CHAPTER - 1
NUMBER SYSTEM

1. Which one of the following is a rational number:

(a) $\sqrt{3}$ (b) $\sqrt{2}$ (c) 0 (d) $\sqrt{5}$

2. 0.6666 in $\frac{p}{q}$ form is:

(a) $\frac{6}{99}$ (b) $\frac{2}{3}$ (c) $\frac{3}{5}$ (d) $\frac{1}{66}$

3. $4\frac{1}{8}$ in decimal form is:

(a) 4.125 (b) $4.\overline{15}$ (c) $4.1\overline{5}$ (d) $0.\overline{415}$

4. The value of $\left(3+\sqrt{3}\right)\left(3-\sqrt{3}\right)$ is:

(a) 0 (b) 6 (c) 9 (d) 3

5. The value of $\left(\sqrt{5}+\sqrt{2}\right)^2$ is:

(a) $7+2\sqrt{5}$ (b) $1+5\sqrt{2}$ (c) $7+2\sqrt{10}$ (d) $7-2\sqrt{10}$

6. The value of $\left(\sqrt{5}+\sqrt{2}\right)\left(\sqrt{5}-\sqrt{2}\right)$ is:

(a) 10 (b) 7 (c) 3 (d) $\sqrt{3}$

7. The value of $\left(3+\sqrt{3}\right)\left(2+\sqrt{2}\right)$ is:

$(a) 6+3\sqrt{2}+2\sqrt{3}+\sqrt{6}$

$(b) 3+3\sqrt{2}+3\sqrt{3}+6$

$(c) 6-3\sqrt{2}-2\sqrt{3}-\sqrt{6}$

$(d) 6-3\sqrt{2}+2\sqrt{3}-\sqrt{6}$

8. The value of $\left(\sqrt{11}+\sqrt{7}\right)\left(\sqrt{11}-\sqrt{7}\right)$ is:

(a) 4 (b) – 4 (c) 18 (d) – 18

9. The value of $\left(5+\sqrt{5}\right)\left(5-\sqrt{5}\right)$ is :

(a) 0 (b) 25 (c) 20 (d) – 20

10. On rationalizing the denominator of $\frac{1}{\sqrt{7}}$, we get

(a) 7 (b) $\frac{\sqrt{7}}{7}$ (c) $\frac{-\sqrt{7}}{7}$ (d) $\sqrt{7}$

MCQ WORKSHEET-III
CLASS IX : CHAPTER - 1
NUMBER SYSTEM

1. On rationalizing the denominator of $\frac{1}{\sqrt{7}-\sqrt{6}}$, we get

(a) $\frac{\sqrt{7}+\sqrt{6}}{\sqrt{7}-\sqrt{6}}$ (b) $\frac{\sqrt{7}-\sqrt{6}}{\sqrt{7}+\sqrt{6}}$ (c) $\sqrt{7}+\sqrt{6}$ (d) $\sqrt{7}-\sqrt{6}$

2. On rationalizing the denominator of $\frac{1}{\sqrt{5}+\sqrt{2}}$, we get

(a) $\sqrt{5}-\sqrt{2}$ (b) $\sqrt{2}-\sqrt{5}$ (c) $\frac{\sqrt{5}-\sqrt{2}}{3}$ (d) $\frac{\sqrt{2}-\sqrt{5}}{3}$

3. On rationalizing the denominator of $\frac{1}{\sqrt{7}-2}$, we get

(a) $\sqrt{7}-2$ (b) $\sqrt{7}+2$ (c) $\frac{\sqrt{7}+2}{3}$ (d) $\frac{\sqrt{7}-2}{3}$

4. On rationalizing the denominator of $\frac{1}{\sqrt{2}}$, we get

(a) 2 (b) $\sqrt{2}$ (c) $\frac{2}{\sqrt{2}}$ (d) $\frac{\sqrt{2}}{2}$

5. On rationalizing the denominator of $\frac{1}{2+\sqrt{3}}$, we get

(a) $2-\sqrt{3}$ (b) $\sqrt{3}-2$ (c) $2+\sqrt{3}$ (d) $-\sqrt{3}-2$

6. On rationalizing the denominator of $\frac{1}{\sqrt{3}-\sqrt{2}}$, we get

(a) $\frac{1}{\sqrt{3}+\sqrt{2}}$ (b) $\sqrt{3}+\sqrt{2}$ (c) $\sqrt{2}-\sqrt{3}$ (d) $-\sqrt{3}-\sqrt{2}$

7. The value of $64^{\frac{1}{2}}$ is :

(a) 8 (b) 4 (c) 16 (d) 32

8. The value of $32^{\frac{1}{5}}$ is :

(a) 16 (b) 160 (c) 2 (d) 18

9. The value of $(125)^{\frac{1}{3}}$ is :

(a) 5 (b) 25 (c) 45 (d) 35

10. The value of $9^{\frac{3}{2}}$ is :

(a) 18 (b) 27 (c) – 18 (d) $\frac{1}{27}$

MCQ WORKSHEET-IV
CLASS IX : CHAPTER - 1
NUMBER SYSTEM

1. The value of $32^{2/5}$ is :
(a) 2 (b) 4 (c) 16 (d) 14

2. The value of $16^{3/4}$ is :
(a) 4 (b) 12 (c) 8 (d) 48

3. The value of $125^{\frac{-1}{3}}$ is :
(a) $\frac{1}{5}$ (b) $\frac{1}{25}$ (c) $\frac{1}{15}$ (d) $\frac{1}{125}$

4. The value of $11^{1/2} \div 11^{1/4}$ is :
(a) $11^{1/4}$ (b) $11^{3/4}$ (c) $11^{1/8}$ (d) $11^{1/2}$

5. The value of $64^{-3/2}$ is :
(a) $\frac{1}{96}$ (b) $\frac{1}{64}$ (c) 512 (d) $\frac{1}{512}$

6. The value of $(125)^{\frac{2}{3}}$ is :
(a) 5 (b) 25 (c) 45 (d) 35

7. The value of $25^{3/2}$ is :
(a) 5 (b) 25 (c) 125 (d) 625

8. The value of $\frac{1}{11}$ in decimal form is:
(a) $0.0\overline{99}$ (b) $0.\overline{909}$ (c) $0.\overline{09}$ (d) $0.00\overline{9}$

9. Decimal expansion of a rational number is terminating if in its denominator there is:
(a) 2 or 5 (b) 3 or 5 (c) 9 or 11 (d) 3 or 7

10. The exponent form of $\sqrt[3]{7}$ is:
(a) 7^3 (b) 3^7 (c) $7^{1/3}$ (d) $3^{1/7}$

MCQ WORKSHEET-V
CLASS IX : CHAPTER - 1
NUMBER SYSTEM

1. Which of the following is true?
(a) Every whole number is a natural number (b) Every integer is a rational number
(c) Every rational number is an integer (d) Every integer is a whole number

2. For Positive real numbers a and b, which is not true?
(a) $\sqrt{ab} = \sqrt{a}\sqrt{b}$ (b) $\left(a+\sqrt{b}\right)\left(a-\sqrt{b}\right) = a^2 - b$
(c) $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ (d) $\left(\sqrt{a}+\sqrt{b}\right)\left(\sqrt{a}-\sqrt{b}\right) = a+b$

3. Out of the following, the irrational number is
(a) $1.\bar{5}$ (b) $2.4\overline{77}$ (c) $1.2\overline{77}$ (d) π

4. To rationalize the denominator of $\frac{1}{\sqrt{a}+b}$,we multiply this by
(a) $\frac{1}{\sqrt{a}+b}$ (b) $\frac{1}{\sqrt{a}-b}$ (c) $\frac{\sqrt{a}+b}{\sqrt{a}+b}$ (d) $\frac{\sqrt{a}-b}{\sqrt{a}-b}$

5. The number of rational numbers between $\sqrt{3}$ and $\sqrt{5}$ is
(a) One (b) 3 (c) none (d) infinitely many

6. If we add two irrational numbers, the resulting number
(a) is always an irrational number (b) is always a rational number
(c) may be a rational or an irrational number (d) always an integer

7. The rationalizing factor of $7-2\sqrt{3}$ is
(a) $7-2\sqrt{3}$ (b) $7+2\sqrt{3}$ (c) $5+2\sqrt{3}$ (d) $4+2\sqrt{3}$

8. If $\frac{1}{7} = 0.\overline{142857}$, then $\frac{4}{7}$ equals
(a) $0.\overline{428571}$ (b) $0.\overline{571428}$ (c) $0.\overline{857142}$ (d) $0.\overline{285718}$

9. The value of n for which $\sqrt{n}$ be a rational number is
(a) 2 (b) 4 (c) 3 (d) 5

10. $\frac{3\sqrt{12}}{6\sqrt{27}}$ equals
(a) $\frac{1}{2}$ (b) $\sqrt{2}$ (c) $\sqrt{3}$ (d) $\frac{1}{3}$

11. $\left(3+\sqrt{3}\right)\left(3-\sqrt{2}\right)$ equals
(a) $9-5\sqrt{2}-\sqrt{6}$ (b) $9-\sqrt{6}$ (c) $3+\sqrt{2}$ (d) $9-3\sqrt{2}+3\sqrt{3}-\sqrt{6}$

12. The arrangement of $\sqrt{2}, \sqrt{5}, \sqrt{3}$ in ascending order is

(a) $\sqrt{2}, \sqrt{3}, \sqrt{5}$ (b) $\sqrt{2}, \sqrt{5}, \sqrt{3}$ (c) $\sqrt{5}, \sqrt{3}, \sqrt{2}$ (d) $\sqrt{3}, \sqrt{2}, \sqrt{5}$

13. If m and n are two natural numbers and $m^n = 32$, then n^{mn} is

(a) 5^2 (b) 5^3 (c) 5^{10} (d) 5^{12}

14. If $\sqrt{10} = 3.162$, then the value of $\frac{1}{\sqrt{10}}$ is

(a) 0.3162 (b) 3.162 (c) 31.62 (d) 316.2

15. If $\left(\frac{3}{4}\right)^6 \times \left(\frac{16}{9}\right)^5 = \left(\frac{4}{3}\right)^{x+2}$, then the value of x is

(a) 2 (b) 4 (c) -2 (d) 6

PRACTICE QUESTIONS

CLASS IX : CHAPTER - 1

NUMBER SYSTEM

1. Prove that $\sqrt{5}-\sqrt{3}$ is not a rational number.

2. Arrange the following in descending order of magnitude: $\sqrt[8]{90}, \sqrt[4]{10}, \sqrt{6}$

3. Simplify the following:

$(i)\left(4\sqrt{3}-2\sqrt{2}\right)\left(3\sqrt{2}+4\sqrt{3}\right)$

$(ii)\left(2+\sqrt{3}\right)\left(3+\sqrt{5}\right)$

$(iii)\left(\sqrt{3}+\sqrt{2}\right)^2$

$(iv)\left(\frac{2}{3}\sqrt{7}-\frac{1}{2}\sqrt{2}+6\sqrt{11}\right)+\left(\frac{1}{3}\sqrt{7}+\frac{3}{2}\sqrt{2}-\sqrt{11}\right)$

4. Rationalize the denominator of the following:

$(i)\ \frac{2}{\sqrt{3}-\sqrt{5}}$ $(ii)\ \frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ $(iii)\frac{6}{\sqrt{5}+\sqrt{2}}$ $(iv)\frac{1}{8+5\sqrt{2}}$

$(v)\frac{3-2\sqrt{2}}{3+2\sqrt{2}}$ $(vi)\frac{\sqrt{3}-1}{\sqrt{3}+1}$ $(vii)\frac{4}{\sqrt{7}+\sqrt{3}}$ $(viii)\frac{1}{5+3\sqrt{2}}$

5. Rationalise the denominator of the following:

$(i)\frac{2}{3\sqrt{3}}$ $(ii)\frac{16}{\sqrt{41}-5}$ $(iii)\frac{\sqrt{5}+\sqrt{2}}{\sqrt{5}-\sqrt{2}}$

$(iv)\frac{\sqrt{40}}{\sqrt{3}}$ $(v)\frac{3+\sqrt{2}}{4\sqrt{2}}$ $(vi)\frac{2+\sqrt{3}}{2-\sqrt{3}}$

$(vii)\frac{\sqrt{6}}{\sqrt{2}+\sqrt{3}}$ $(viii)\frac{3\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$ $(ix)\frac{4\sqrt{3}+5\sqrt{2}}{\sqrt{48}+\sqrt{18}}$

6. If $a=6-\sqrt{35}$, find the value of $a^2+\frac{1}{a^2}$.

7. If $x=3+\sqrt{8}$, find the value of (i) $x^2+\frac{1}{x^2}$ and (ii) $x^4+\frac{1}{x^4}$

8. Simplify, by rationalizing the denominator $\frac{2\sqrt{6}}{\sqrt{2}+\sqrt{3}}+\frac{6\sqrt{2}}{\sqrt{6}+\sqrt{3}}-\frac{8\sqrt{3}}{\sqrt{6}+\sqrt{2}}$

9. Simplify, by rationalizing the denominator

$$\frac{1}{3-\sqrt{8}}-\frac{1}{\sqrt{8}-\sqrt{7}}+\frac{1}{\sqrt{7}-\sqrt{6}}-\frac{1}{\sqrt{6}-\sqrt{5}}+\frac{1}{\sqrt{5}-2}$$

10. If $x=\frac{\sqrt{2}+1}{\sqrt{2}-1}$ and $y=\frac{\sqrt{2}-1}{\sqrt{2}+1}$, find the value of x^2+y^2+xy.

11. If $x=\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ and $y=\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}$, find the value of x^2+y^2.

12. If $x=\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$ and $y=\frac{\sqrt{5}-\sqrt{3}}{\sqrt{5}+\sqrt{3}}$, find the value of $x+y+xy$.

13. If $x=\frac{2-\sqrt{5}}{2+\sqrt{5}}$ and $y=\frac{2+\sqrt{5}}{2-\sqrt{5}}$, find the value of x^2-y^2.

14. If $\frac{5+2\sqrt{3}}{7+\sqrt{3}}=a-\sqrt{3}b$, find a and b where a and b are rational numbers.

15. If a and b are rational numbers and $\frac{4+3\sqrt{5}}{4-3\sqrt{5}}=a+b\sqrt{5}$, find the values of a and b.

16. If a and b are rational numbers and $\frac{2+\sqrt{3}}{2-\sqrt{3}}=a+b\sqrt{3}$, find the values of a and b.

17. If a and b are rational numbers and $\frac{\sqrt{11}-\sqrt{7}}{\sqrt{11}+\sqrt{7}}=a-b\sqrt{77}$, find the values of a and b.

18. Evaluate: $\frac{1}{\sqrt{2}+1}+\frac{1}{\sqrt{3}+\sqrt{2}}+\frac{1}{\sqrt{4}+\sqrt{3}}+.....+\frac{1}{\sqrt{9}+\sqrt{8}}$

19. If $x=\frac{1}{2+\sqrt{3}}$, find the value of $2x^3-7x^2-2x+1$.

20. If $x=\frac{1}{2-\sqrt{3}}$, find the value of x^3-2x^2-7x+5.

21. If $\sqrt{2}=1.414$ and $\sqrt{5}=2.236$, find the value of $\frac{\sqrt{10}-\sqrt{5}}{2\sqrt{2}}$ upto three places of decimals.

22. Find six rational numbers between 3 and 4.

23. Find five rational numbers between $\frac{3}{5}$ and $\frac{4}{5}$

24. Find the value of a and b in $\frac{\sqrt{3}-1}{\sqrt{3}+1}=a+b\sqrt{3}$.

25. Find the value of a and b in $\frac{5+2\sqrt{3}}{7+4\sqrt{3}}=a+b\sqrt{3}$

26. Find the value of a and b in $\frac{5-\sqrt{6}}{5+\sqrt{6}}=a-b\sqrt{6}$

27. Simplify $\frac{4+\sqrt{5}}{4-\sqrt{5}}+\frac{4-\sqrt{5}}{4+\sqrt{5}}$ by rationalizing the denominator.

28. Simplify $\frac{\sqrt{5}-1}{\sqrt{5}+1}+\frac{\sqrt{5}+1}{\sqrt{5}-1}$ by rationalizing the denominator.

29. Simplify $\frac{\sqrt{3}-\sqrt{2}}{\sqrt{3}+\sqrt{2}}+\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$ by rationalizing the denominator.

30. If x = $\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$, find (i) $x^2+\frac{1}{x^2}$ (ii) $x^4+\frac{1}{x^4}$.

31. If x = $4-\sqrt{15}$, find (i) $x^2+\frac{1}{x^2}$ (ii) $x^4+\frac{1}{x^4}$.

32. If x = $2+\sqrt{3}$, find (i) $x^2+\frac{1}{x^2}$ (ii) $x^4+\frac{1}{x^4}$.

33. Represent the real number $\sqrt{10}$ on the number line.

34. Represent the real number $\sqrt{13}$ on the number line.

35. Represent the real number $\sqrt{7}$ on the number line.

36. Represent the real number $\sqrt{2}, \sqrt{3}, \sqrt{5}$ on a single number line.

37. Find two rational number and two irrational number between $\sqrt{2}$ and $\sqrt{3}$.

38. Find the decimal expansions of $\frac{10}{3}, \frac{7}{8}$ and $\frac{1}{7}$.

39. Show that 3.142678 is a rational number. In other words, express 3.142678 in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

40. Show that 0.3333……. can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

41. Show that 1.27272727……. can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

42. Show that 0.23535353……. can be expressed in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

43. Express the following in the form of $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

$(i) 0.\overline{6}$ $(ii) 0.4\overline{7}$ $(iii) 0.\overline{001}$ $(iv) 0.2\overline{6}$

44. Find three different irrational numbers between the rational numbers $\frac{5}{7}$ and $\frac{9}{11}$.

45. Visualize the representation of $5.3\overline{7}$ using successive magnification

46. Visualize $4.\overline{26}$ on the number line, using successive magnification upto 4 decimal places.

47. Visualize 3.765 on the number line, using successive magnification.

48. Find the value of a and b in each of the following:

$(i) \frac{3+\sqrt{2}}{3-\sqrt{2}} = a + b\sqrt{2}$ $(ii) \frac{3+\sqrt{7}}{3-\sqrt{7}} = a + b\sqrt{7}$ $(iii) \frac{7+\sqrt{5}}{7-\sqrt{5}} = a + b\sqrt{5}$

49. Simplify each of the following by rationalizing the denominator.

$(i) \frac{6-4\sqrt{2}}{6+4\sqrt{2}}$ $(ii) \frac{\sqrt{5}-2}{\sqrt{5}+2} - \frac{\sqrt{5}+2}{\sqrt{5}-2}$

50. Evaluate the following expressions:

$(i) \left(\frac{256}{6561}\right)^{\frac{3}{8}}$ $(ii) \left(15625\right)^{\frac{1}{6}}$ $(iii) \left(\frac{343}{1331}\right)^{\frac{1}{3}}$

$(iv) \sqrt[8]{\frac{6561}{65536}}$ $(v) 343^{-\frac{1}{3}}$

51. Simplify: $\frac{\sqrt{32}+\sqrt{48}}{\sqrt{8}+\sqrt{12}}$

52. Simplify: $\frac{7}{3\sqrt{3}-2\sqrt{2}}$

53. Simplify: $(i)\ \sqrt[4]{\sqrt[3]{2^2}}$ $(ii)\sqrt[3]{2}.\sqrt[4]{2}.\sqrt[12]{32}$

54. If $\sqrt{2}=1.4142$, then find the value of $\sqrt{\frac{\sqrt{2}+1}{\sqrt{2}-1}}$.

55. If $\sqrt{3}=1.732$, then find the value of $\sqrt{\frac{\sqrt{3}+1}{\sqrt{3}-1}}$.

56. Find the value of a if $\frac{6}{3\sqrt{2}-2\sqrt{3}}=3\sqrt{2}-a\sqrt{3}$

57. Evaluate the following expressions:

$(i)\left(\frac{625}{81}\right)^{-\frac{1}{4}}$ $(ii)27^{\frac{2}{3}}\times 27^{\frac{1}{3}}\times 27^{-\frac{4}{3}}$ $(iii)\left(6.25\right)^{\frac{3}{2}}$

$(iv)\left(0.000064\right)^{\frac{5}{6}}$ $(v)\left(17^2-8^2\right)^{\frac{1}{2}}$

58. Express $0.6+0.\overline{7}+0.4\overline{7}$ in the form of $\frac{p}{q}$, where p and q are integers and $q\neq 0$.

59. Simplify: $\frac{7\sqrt{3}}{\sqrt{10}+\sqrt{3}}-\frac{2\sqrt{5}}{\sqrt{6}+\sqrt{5}}-\frac{3\sqrt{2}}{\sqrt{15}+3\sqrt{2}}$

60. If $\sqrt{2}=1.414,\sqrt{3}=1.732$, then find the value of $\frac{4}{3\sqrt{3}-2\sqrt{2}}+\frac{3}{3\sqrt{3}+2\sqrt{2}}$.

61. Simplify:

$(i)\ \left[5\left(8^{\frac{1}{3}}+27^{\frac{1}{3}}\right)^3\right]^{\frac{1}{4}}$ $(ii)\sqrt{45}-3\sqrt{20}+4\sqrt{5}$ $(iii)\frac{\sqrt{24}}{8}+\frac{\sqrt{54}}{9}$

$(iv)\sqrt[4]{12}\times\sqrt[6]{7}$ $(v)\sqrt[4]{28}\div\sqrt[3]{7}$ $(vi)\sqrt[3]{3}+2\sqrt{27}+\frac{1}{\sqrt{3}}$

$(vii)\left(\sqrt{3}-\sqrt{5}\right)^2$ $(viii)\sqrt[4]{81}-8\sqrt[3]{216}+15\sqrt[5]{32}+\sqrt{225}$

$(ix)\frac{3}{\sqrt{8}}+\frac{1}{\sqrt{2}}$ $(x)\frac{\sqrt[2]{3}}{3}-\frac{\sqrt{3}}{6}$

62. If $a=\frac{3+\sqrt{5}}{2}$ then find the value of $a^2+\frac{1}{a^2}$.

63. Simplify: $\left(256\right)^{\left(-4^{\frac{-3}{2}}\right)}$

64. Find the value of $\frac{4}{\left(216\right)^{\frac{-2}{3}}}+\frac{1}{\left(256\right)^{\frac{-3}{4}}}+\frac{2}{\left(243\right)^{\frac{-1}{5}}}$

65. If $a=5+2\sqrt{6}$ and $b=\frac{1}{a}$ then what will be the value of $a^2 + b^2$?

66. Find the value of a and b in each of the following:

$(i)\dfrac{3-\sqrt{5}}{3+2\sqrt{5}}=a\sqrt{5}-\dfrac{19}{11}$

$(ii)\dfrac{\sqrt{2}+\sqrt{3}}{3\sqrt{2}-2\sqrt{3}}=2-b\sqrt{6}$

$(iii)\dfrac{7+\sqrt{5}}{7-\sqrt{5}}-\dfrac{7-\sqrt{5}}{7+\sqrt{5}}=a+\dfrac{7}{11}b\sqrt{5}$

67. If $a=2+\sqrt{3}$, then find the value of $a-\dfrac{1}{a}$.

68. Rationalise the denominator in each of the following and hence evaluate by taking $\sqrt{2}=1.414, \sqrt{3}=1.732$ and $\sqrt{5}=2.236$, upto three places of decimal.

$(i)\dfrac{4}{\sqrt{3}}$ $(ii)\dfrac{6}{\sqrt{6}}$ $(iii)\dfrac{\sqrt{10}-\sqrt{5}}{2}$ $(iv)\dfrac{\sqrt{2}}{2+\sqrt{2}}$ $(v)\dfrac{1}{\sqrt{3}+\sqrt{2}}$

69. Simplify:

$(i)\left(1^3+2^3+3^3\right)^{\frac{1}{2}}$ $(ii)\left(\dfrac{3}{5}\right)^4\left(\dfrac{8}{5}\right)^{-12}\left(\dfrac{32}{5}\right)^6$ $(iii)\left(-\dfrac{1}{27}\right)^{\frac{-2}{3}}$

$(iv)\left[\left(\left(625\right)^{\frac{-1}{2}}\right)^{\frac{-1}{4}}\right]^2$ $(v)\dfrac{8^{\frac{1}{3}}\times16^{\frac{1}{3}}}{32^{\frac{-1}{3}}}$ $(vi)64^{\frac{-1}{3}}\left[64^{\frac{1}{3}}-64^{\frac{2}{3}}\right]$

70. Simplify: $\dfrac{9^{\frac{1}{3}}\times27^{\frac{-1}{2}}}{3^{\frac{1}{6}}\times3^{\frac{-2}{3}}}$

MCQ WORKSHEET-I
CLASS IX : CHAPTER - 2
POLYNOMIALS

1. In $2 + x + x^2$ the coefficient of x^2 is:
(a) 2 (b) 1 (c) – 2 (d) –1

2. In $2 – x^2 + x^3$ the coefficient of x^2 is:
(a) 2 (b) 1 (c) – 2 (d) –1

3. In $\frac{\pi x^2}{2} + x + 10$, the coefficient of x^2 is:
(a) $\frac{\pi}{2}$ (b) 1 (c) $-\frac{\pi}{2}$ (d) –1

4. The degree of $5t – 7$ is:
1. 0 (b) 1 (c) 2 (d) 3

5. The degree of $4 – y^2$ is:
(a) 0 (b) 1 (c) 2 (d) 3

6. The degree of 3 is:
(a) 0 (b) 1 (c) 2 (d) 3

7. The value of $p(x) = 5x – 4x^2 + 3$ for $x = 0$ is:
(a) 3 (b) 2 (c) – 3 (d) – 2

8. The value of $p(x) = 5x – 4x^2 + 3$ for $x = – 1$ is:
(a) 6 (b) –6 (c) 3 (d) – 3

9. The value of $p(x) = (x – 1)(x + 1)$ for $p(1)$ is:
(a) 1 (b) 0 (c) 2 (d) – 2

10. The value of $p(t) = 2 + t + 2t^2 – t^3$ for $p(0)$ is:
(a) 1 (b) 2 (c) – 1 (d) 3

11. The value of $p(t) = 2 + t + 2t^2 – t^3$ for $p(2)$ is:
(a) 4 (b) –4 (c) 6 (d) 7

12. The value of $p(y) = y^2 – y + 1$ for $p(0)$ is:
(a) –1 (b) 3 (c) –2 (d) 1

MCQ WORKSHEET-ii
CLASS IX : CHAPTER - 2
POLYNOMIALS

1. The zero of p(x) = 2x – 7 is:
(a) $\frac{7}{2}$ (b) $\frac{2}{7}$ (c) $\frac{-2}{7}$ (d) $\frac{-7}{2}$

2. The zero of p(x) = 9x + 4 is:
(a) $\frac{4}{9}$ (b) $\frac{9}{4}$ (c) $\frac{-4}{9}$ (d) $\frac{-9}{4}$

3. Which are the zeroes of p(x) = x^2 – 1:
(a) 1, –1 (b) – 1, 2 (c) –2, 2 (d) –3, 3

4. Which are the zeroes of p(x) = (x – 1)(x – 2):
(a) 1, –2 (b) – 1, 2 (c) 1, 2 (d) –1, –2

5. Which one of the following is the zero of p(x) = lx + m
(a) $\frac{m}{l}$ (b) $\frac{l}{m}$ (c) $-\frac{m}{l}$ (d) $-\frac{l}{m}$

6. Which one of the following is the zero of p(x) = $5x-\pi$:
(a) $-\frac{4}{5}\pi$ (b) $\frac{1}{5}\pi$ (c) $\frac{4}{5}\pi$ (d) none of these

7. On dividing $x^3 + 3x^2 + 3x + 1$ by x we get remainder:
(a) 1 (b) 0 (c) – 1 (d) 2

8. On dividing $x^3 + 3x^2 + 3x + 1$ by $x+\pi$ we get remainder:
$(a)-\pi^3+3\pi^2-3\pi+1$
$(b)\pi^3-3\pi^2+3\pi+1$
$(c)-\pi^3-3\pi^2-3\pi-1$
$(d)-\pi^3+3\pi^2-3\pi-1$

9. On dividing $x^3 + 3x^2 + 3x + 1$ by 5 + 2x we get remainder:
(a) $\frac{8}{27}$ (b) $\frac{27}{8}$ (c) $-\frac{27}{8}$ (d) $-\frac{8}{27}$

10. If x – 2 is a factor of x^3 – 3x +5a then the value of a is:
(a) 1 (b) –1 (c) $\frac{2}{5}$ (d) $\frac{-2}{5}$

MCQ WORKSHEET-III
CLASS IX : CHAPTER - 2
POLYNOMIALS

1. $(x + 8)(x – 10)$ in the expanded form is:
(a) $x^2 – 8x – 80$ (b) $x^2 – 2x – 80$ (c) $x^2 + 2x + 80$ (d) $x^2 – 2x + 80$

2. The value of 95 x 96 is:
(a) 9020 (b) 9120 (c) 9320 (d) 9340

3. The value of 104 x 96 is:
(a) 9984 (b) 9624 (c) 9980 (d) 9986

4. Without actual calculating the cubes the value of $28^3 + (–15)^3 + (–13)^3$ is:
(a) 16380 (b) –16380 (c) 15380 (d) –15380

5. If $x – 2$ is a factor of $x^3 – 2ax^2 + ax – 1$ then the value of a is:
(a) $\frac{7}{6}$ (b) $\frac{-7}{6}$ (c) $\frac{6}{7}$ (d) $\frac{-6}{7}$

6. If $x + 2$ is a factor of $x^3 + 2ax^2 + ax – 1$ then the value of a is:
(a) $\frac{2}{3}$ (b) $\frac{3}{5}$ (c) $\frac{3}{2}$ (d) $\frac{1}{2}$

7. If $x + y + z = 0$ then $x^3 + y^3 + z^3$ is equal to
(a) 3xyz (b) – 3xyz (c) xy (d) –2xy

8. The factors of $2x^2 – 7x + 3$ are:
(a) $(x – 3)(2x – 1)$ (b) $(x + 3)(2x + 1)$
(c) $(x – 3)(2x + 1)$ (d) $(x + 3)(2x – 1)$

9. The factors of $6x^2 + 5x – 6$ are:
(a) $(2x – 3)(3x – 2)$ (b) $(2x – 3)(3x + 2)$
(c) $(2x + 3)(3x – 2)$ (d) $(2x + 3)(3x + 2)$

10. The factors of $3x^2 – x – 4$ are:
(a) $(3x – 4)(x – 1)$ (b) $(3x – 4)(x + 1)$
(c) $(3x + 4)(x – 1)$ (d) $(3x + 4)(x + 1)$

11. The factors of $12x^2 – 7x + 1$ are:
(a) $(4x – 1)(3x – 1)$ (b) $(4x – 1)(3x + 1)$
(c) $(4x + 1)(3x – 1)$ (d) $(4x + 1)(3x + 1)$

12. The factors of $x^3 – 2x^2 – x + 2$ are:
(a) $(x – 1)(x – 1)(x – 5)$ (b) $(x + 1)(x + 1)(x + 5)$
(c) $(x + 1)(x – 1)(x + 5)$ (d) $(x + 1)(x + 1)(x – 5)$

MCQ WORKSHEET-Iv
CLASS IX : CHAPTER - 2
POLYNOMIALS

1. Which of the following is not a polynomial?
(a) $x^2+\sqrt{2}x+3$ (b) $x^2+\sqrt{2x}+6$ (c) x^3+3x^2-3 (d) $6x+4$

2. The degree of the polynomial $3x^3 - x^4 + 5x + 3$ is
(a) –4 (b) 4 (c) 1 (d) 3

3. Zero of the polynomial $p(x) = a^2x$, $a \neq 0$ is
(a) x = 0 (b) x = 1 (c) x = –1 (d) a = 0

4. Which of the following is a term of a polynomial?
(a) 2x (b) $\frac{3}{x}$ (c) $x^{\sqrt{x}}$ (d) $\sqrt{x}$

5. If $p(x) = 5x^2 - 3x + 7$, then p(1) equals
(a) –10 (b) 9 (c) –9 (d) 10

6. Factorisation of $x^3 + 1$ is
(a) $(x + 1)(x^2 – x + 1)$ (b) $(x + 1)(x^2 + x + 1)$
(c) $(x + 1)(x^2 – x – 1)$ (d) $(x + 1)(x^2 + 1)$

7. If x + y + 2 = 0, then $x^3 + y^3 + 8$ equals
(a) $(x + y + 2)^3$ (b) 0 (c) 6xy (d) –6xy

8. If x = 2 is a zero of the polynomial $2x^2 + 3x – p$, then the value of p is
(a) –4 (b) 0 (c) 8 (d) 14

9. $x+\frac{1}{x}$ is
(a) a polynomial of degree 1 (b) a polynomial of degree 2
(c) a polynomial of degree 3 (d) not a polynomial

10. Integral zeroes of the polynomial (x + 3)(x – 7) are
(a) –3, –7 (b) 3, 7 (c) –3, 7 (d) 3, –7

11. The remainder when $p(x) = 2x^2 – x – 6$ is divided by (x – 2) is
(a) p(– 2) (b) p(2) (c) p(3) (d) p(–3)

12. If $2\left(a^2+b^2\right)=\left(a+b\right)^2$, then
(a) a + b = 0 (b) a = b (c) 2a = b (d) ab = 0

13. If $x^3 + 3x^2 + 3x + 1$ is divided by (x + 1), then the remainder is
(a) –8 (b) 0 (c) 8 (d) $\frac{1}{8}$

14. The value of $(525)^2 – (475)^2$ is
(a) 100 (b) 1000 (c) 100000 (d) –100

15. If a + b = –1, then the value of $a^3 + b^3 - 3ab$ is

(a) –1 (b) 1 (c) 26 (d) –26

16. The value of $(2-a)^3 + (2-b)^3 + (2-c)^3 - 3(2-a)(2-b)(2-c)$ when a + b + c = 6 is

(a) –3 (b) 3 (c) 0 (d) –1

17. If $\frac{a}{b} + \frac{b}{a} = 1, (a \neq 0, b \neq 0)$, then the value of $a^3 - b^3$ is

(a) –1 (b) 0 (c) 1 (d) $\frac{1}{2}$

18. If $x = \frac{1}{2-\sqrt{3}}$, then the value of $(x^2 - 4x + 1)$ is

(a) –1 (b) 0 (c) 1 (d) 3

19. The number of zeroes of the polynomial $x^3 + x - 3 - 3x^2$ is

(a) 1 (b) 2 (c) 0 (d) 3

20. If (x + 2) and (x – 2) are factors of $ax^4 + 2x - 3x^2 + bx - 4$, then the value of a + b is

(a) –7 (b) 7 (c) 14 (d) –8

PRACTICE QUESTIONS
CLASS IX : CHAPTER - 2
POLYNOMIALS

1. Factorize the following: $9x^2 + 6x + 1 - 25y^2$.

2. Factorize the following: $a^2 + b^2 + 2ab + 2bc + 2ca$

3. Show that $p(x) = x^3 - 3x^2 + 2x - 6$ has only one real zero.

4. Find the value of a if x + 6 is a factor of $x^3 + 3x^2 + 4x + a$.

5. If polynomials $ax^3 + 3x^2 - 3$ and $2x^3 - 5x + a$ leaves the same remainder when each is divided by x – 4, find the value of a..

6. The polynomial $f(x)= x^4 - 2x^3 + 3x^2 - ax + b$ when divided by (x – 1) and (x + 1) leaves the remainders 5 and 19 respectively. Find the values of a and b. Hence, find the remainder when f(x) is divided by (x – 2).

7. If the polynomials $2x^3 + ax^2 + 3x - 5$ and $x^3 + x^2 - 2x + a$ leave the same remainder when divided by (x – 2), find the value of a. Also, find the remainder in each case.

8. If the polynomials $az^3 + 4z^2 + 3z - 4$ and $z^3 - 4z + a$ leave the same remainder when divided by $z - 3$, find the value of a.

9. The polynomial $p(x) = x^4 - 2x^3 + 3x^2 - ax + 3a - 7$ when divided by $x + 1$ leaves the remainder 19. Find the values of a. Also find the remainder when $p(x)$ is divided by $x + 2$.

10. If both $x - 2$ and $x - \frac{1}{2}$ are factors of $px^2 + 5x + r$, show that $p = r$.

11. Without actual division, prove that $2x^4 - 5x^3 + 2x^2 - x + 2$ is divisible by $x^2 - 3x + 2$.

12. Simplify $(2x - 5y)^3 - (2x + 5y)^3$.

13. Multiply $x^2 + 4y^2 + z^2 + 2xy + xz - 2yz$ by $(-z + x - 2y)$.

14. If a, b, c are all non-zero and $a + b + c = 0$, prove that $\frac{a^2}{bc} + \frac{b^2}{ca} + \frac{c^2}{ab} = 3$

15. If $a + b + c = 5$ and $ab + bc + ca = 10$, then prove that $a^3 + b^3 + c^3 - 3abc = -25$.

16. Without actual division, prove that $2x^4 - 6x^3 + 3x^2 + 3x - 2$ is exactly divisible by $x^2 - 3x + 2$.

17. Without actual division, prove that $x^3 - 3x^2 - 13x + 15$ is exactly divisible by $x^2 + 2x - 3$.

18. Find the values of a and b so that the polynomial $x^3 - 10x^2 + ax + b$ is exactly divisible by (x – 1) as well as (x – 2).

19. Find the integral zeroes of the polynomial $2x^3 + 5x^2 - 5x - 2$.

20. If (x – 3) and $\left(x - \frac{1}{3}\right)$ are both factors of $ax^2 + 5x + b$, then show that a = b.

21. Find the values of a and b so that the polynomial $x^4 + ax^3 - 7x^2 + 8x + b$ is exactly divisible by (x + 2) as well as (x + 3).

22. If $x^3 + ax^2 + bx + 6$ has $(x - 2)$ as a factor and leaves a remainder 3 when divided by $(x - 3)$, find the values of a and b.

23. Find the value of $x^3 + y^3 + 15xy - 125$ if $x + y = 5$.

24. Without actually calculating, find the value of $(25)^3 - (75)^3 + (50)^3$.

25. Factorise each of the following cubic expressions:

(i) $8x^3 - y^3 - 12x^2y + 6xy^2$

(ii) $27q^3 - 125p^3 - 135q^2p + 225qp^2$

(iii) $8x^3 + 729 + 108x^2 + 486x$

(iv) $27x^3 - \frac{1}{216} - \frac{9}{2}x^2 + \frac{1}{4}x$

26. Factorise:

(i) $x^3 + 216y^3 + 8z^3 - 36xyz$

(ii) $a^3 - 64b^3 - 27c^3 - 36abc$

27. Factorise: $\left(\frac{1}{2}x - 3y\right)^3 + \left(3y - \sqrt{3}z\right)^3 + \left(\sqrt{3}z - \frac{1}{2}x\right)^3$

28. Give one example each of a binomial of degree 35, and of a monomial of degree 100.

29. Find a zero of the polynomial $p(x) = 2x + 1$.

30. Verify whether 2 and 0 are zeroes of the polynomial $x^2 - 2x$.

31. Find the zero of the polynomial in each of the following cases:

(i) $p(x) = x + 5$ (ii) $p(x) = x - 5$ (iii) $p(x) = 2x + 5$

(iv) $p(x) = 3x - 2$ (v) $p(x) = 3x$ (vi) $p(x) = ax$, $a \neq 0$

32. Find the value of each of the following polynomials at the indicated value of variables:

(i) $p(x) = 5x^2 - 3x + 7$ at $x = 1$.

(ii) $q(y) = 3y^3 - 4y + \sqrt{11}$ at $y = 2$.

(iii) $p(t) = 4t^4 + 5t^3 - t^2 + 6$ at $t = a$.

33. Divide $p(x)$ by $g(x)$, where $p(x) = x + 3x^2 - 1$ and $g(x) = 1 + x$.

34. Divide the polynomial $3x^4 - 4x^3 - 3x - 1$ by $x - 1$.

35. Find the remainder obtained on dividing $p(x) = x^3 + 1$ by $x + 1$.

36. Find the remainder when $x^4 + x^3 - 2x^2 + x + 1$ is divided by $x - 1$.

37. Check whether the polynomial $q(t) = 4t^3 + 4t^2 - t - 1$ is a multiple of $2t + 1$.

38. Check whether p(x) is a multiple of g(x) or not, where $p(x) = x^3 - x + 1$, $g(x) = 2 - 3x$.

39. Check whether g(x) is a factor of p(x) or not, where $p(x) = 8x^3 - 6x^2 - 4x + 3$, $g(x) = \frac{x}{3} - \frac{1}{4}$.

40. Find the remainder when $x^3 - ax^2 + 6x - a$ is divided by $x - a$.

41. Examine whether $x + 2$ is a factor of $x^3 + 3x^2 + 5x + 6$ and of $2x + 4$.

42. Find the value of k, if $x - 1$ is a factor of $4x^3 + 3x^2 - 4x + k$.

43. Find the value of a, if $x - a$ is a factor of $x^3 - ax^2 + 2x + a - 1$.

44. Factorise $6x^2 + 17x + 5$

45. Factorise $y^2 - 5y + 6$

46. Factorise $x^3 - 23x^2 + 142x - 120$.

47. Factorise :
(i) $x^3 - 2x^2 - x + 2$ (ii) $x^3 - 3x^2 - 9x - 5$
(iii) $x^3 + 13x^2 + 32x + 20$ (iv) $2y^3 + y^2 - 2y - 1$

48. Factorise : $4x^2 + 9y^2 + 16z^2 + 12xy - 24yz - 16xz$

49. Expand $(4a - 2b - 3c)^2$.

50. Factorise $4x^2 + y^2 + z^2 - 4xy - 2yz + 4xz$.

51. If $x + 1$ is a factor of $ax3 + x2 - 2x + 4a - 9$, find the value of a.

52. By actual division, find the quotient and the remainder when the first polynomial is divided by the second polynomial : $x^4 + 1$; $x - 1$

53. Find the zeroes of the polynomial : $p(x) = (x - 2)^2 - (x + 2)^2$

54. Factorise :
(i) $x^2 + 9x + 18$ (ii) $6x^2 + 7x - 3$
(iii) $2x^2 - 7x - 15$ (iv) $84 - 2r - 2r^2$

55. Factorise :
(i) $2x^3 - 3x^2 - 17x + 30$ (ii) $x^3 - 6x^2 + 11x - 6$
(iii) $x^3 + x^2 - 4x - 4$ (iv) $3x^3 - x^2 - 3x + 1$

56. Using suitable identity, evaluate the following:
(i) 103^3 (ii) 101×102 (iii) 999^2

57. Factorise the following:
(i) $4x^2 + 20x + 25$
(ii) $9y^2 - 66yz + 121z^2$
(iii) $\left(2x + \frac{1}{3}\right)^2 - \left(x - \frac{1}{2}\right)^2$

58. Factorise the following :
(i) $9x^2 - 12x + 3$ (ii) $9x^2 - 12x + 4$

59. If $a + b + c = 9$ and $ab + bc + ca = 26$, find $a^2 + b^2 + c^2$.

60. Expand the following :
(i) $(4a - b + 2c)^2$
(ii) $(3a - 5b - c)^2$

(iii) $(-x + 2y - 3z)^2$

61. Find the value of
(i) $x^3 + y^3 - 12xy + 64$, when $x + y = -4$
(ii) $x^3 - 8y^3 - 36xy - 216$, when $x = 2y + 6$

62. Factorise the following :
(i) $9x^2 + 4y^2 + 16z^2 + 12xy - 16yz - 24xz$
(ii) $25x^2 + 16y^2 + 4z^2 - 40xy + 16yz - 20xz$
(iii) $16x^2 + 4y^2 + 9z^2 - 16xy - 12yz + 24\,xz$

63. Expand the following :
(i) $(3a - 2b)^3$ (ii) $\left(\frac{1}{x} + \frac{y}{3}\right)^3$ (iii) $\left(4 - \frac{1}{3x}\right)^3$

64. Find the following products:
(i) $\left(\frac{x}{2} + 2y\right)\left(\frac{x^2}{4} - xy + 4y^2\right)$ (ii) $(x^2 - 1)(x^4 + x^2 + 1)$

65. Factorise the following :
(i) $8p^3 + \frac{12}{5}p^2 + \frac{6}{25}p + \frac{1}{125}$
(ii) $1 - 64a^3 - 12a + 48a^2$

66. Without finding the cubes, factorise $(x - 2y)^3 + (2y - 3z)^3 + (3z - x)^3$

67. Give possible expressions for the length and breadth of the rectangle whose area is given by $4a^2 + 4a - 3$.

68. Factorise: (i) $1 + 64x^3$ (ii) $a^3 - 2\sqrt{2}b^3$

69. Evaluate each of the following using suitable identities:
(i) $(104)^3$ (ii) $(999)^3$

70. Factorise : $8x^3 + 27y^3 + 36x^2y + 54xy^2$

71. Factorise : $8x^3 + y^3 + 27z^3 - 18xyz$

72. Verify : (i) $x^3 + y^3 = (x + y)(x^2 - xy + y^2)$ (ii) $x^3 - y^3 = (x - y)(x^2 + xy + y^2)$

73. Factorise each of the following:
(i) $27y^3 + 125z^3$ (ii) $64m^3 - 343n^3$

74. Factorise : $27x^3 + y^3 + z^3 - 9xyz$

75. Without actually calculating the cubes, find the value of each of the following:
(i) $(-12)^3 + (7)^3 + (5)^3$
(ii) $(28)^3 + (-15)^3 + (-13)^3$

76. Find the following product :$(2x - y + 3z)(4x^2 + y^2 + 9z^2 + 2xy + 3yz - 6xz)$

77. Factorise :
(i) $a^3 - 8b^3 - 64c^3 - 24abc$ (ii) $2\sqrt{2}\,a^3 + 8b^3 - 27c^3 + 18\,\sqrt{2}\,abc$.

78. Give possible expressions for the length and breadth of rectangles, in which its areas is given by $35y^2 + 13y - 12$

79. Without actually calculating the cubes, find the value of :

$(i)\left(\frac{1}{2}\right)^3 + \left(\frac{1}{3}\right)^3 - \left(\frac{5}{6}\right)^3$ $\qquad$ $(ii)\left(0.2\right)^3 - \left(0.3\right)^3 + \left(0.1\right)^3$

80. By Remainder Theorem find the remainder, when $p(x)$ is divided by $g(x)$, where
(i) $p(x) = x^3 - 2x^2 - 4x - 1$, $g(x) = x + 1$
(ii) $p(x) = x^3 - 3x^2 + 4x + 50$, $g(x) = x - 3$
(iii) $p(x) = 4x^3 - 12x^2 + 14x - 3$, $g(x) = 2x - 1$
(iv) $p(x) = x^3 - 6x^2 + 2x - 4$, $g(x) = 1 - \frac{3}{2}x$

81. Check whether $p(x)$ is a multiple of $g(x)$ or not :
(i) $p(x) = x^3 - 5x^2 + 4x - 3$, $g(x) = x - 2$
(ii) $p(x) = 2x^3 - 11x^2 - 4x + 5$, $g(x) = 2x + 1$

82. Show that $p - 1$ is a factor of $p^{10} - 1$ and also of $p^{11} - 1$.

83. For what value of m is $x^3 - 2mx^2 + 16$ divisible by $x + 2$?

84. If $x + 2a$ is a factor of $x^5 - 4a^2x^3 + 2x + 2a + 3$, find a.

85. Find the value of m so that $2x - 1$ be a factor of $8x^4 + 4x^3 - 16x^2 + 10x + m$.

86. Show that :
(i) $x + 3$ is a factor of $69 + 11x - x^2 + x^3$.
(ii) $2x - 3$ is a factor of $x + 2x^3 - 9x^2 + 12$.

87. If $x + y = 12$ and $xy = 27$, find the value of $x^3 + y^3$.

88. Without actually calculating the cubes, find the value of $48^3 - 30^3 - 18^3$.

89. Without finding the cubes, factorise $(2x - 5y)^3 + (5y - 3z)^3 + (3z - 2x)^3$.

90. Without finding the cubes, factorise $(x - y)^3 + (y - z)^3 + (z - x)^3$.