SELECTION

8

MATHS

ANBU NILAYAM
MADURAI - 625001

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SELECTION

⑧ MATHS

TERM - III

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CONTENT

SELECTION ⑧ MATHS TERM - III

Unit - 1. NUMBERS

Exercise 1.1

1. Fill in the blanks:

(i) The ones digit in the square of 77 is_____.

Solution :

9

(ii) The number of non-square numbers between 24^2 and 25^2 is _____.

Solution :

48 (576 - 625)

(iii) If a number ends with 5, its square ends with _____.

Solution :

5

(iv) A square number will not end with numbers _____.

Solution :

2, 3, 7, 8

(v) The number of perfect square numbers between 300 and 500 is _____.

Solution :

5 (324, 361, 400, 441, 484)

---

2. Say True or False:

(i) When a square number ends in 6, its square root will have 6 in the unit's place.

Solution :

True

(ii) A square number will not have odd number of zeros at the end.

Solution :

True

(iii) The number of zeros in the square of 961000 is 9.

Solution :

False

(iv) (7, 24, 25) is a Pythagorean triplet.

Solution :

True

(v) The square root of 221 is 21.

Solution :

False

---

3. What will be the ones' digit in the squares of the following numbers?

(i) 36

Solution : 6

(ii) 252

Solution : 4

(iii) 543

Solution : 9

---

4. Study the given numbers and justify why each of them obviously cannot be a perfect square.

(i) 1000

Solution :

Odd numbers of Zeroes

(ii) 34567

Solution :

Cannot end with 7

(iii) 408

Solution :

Cannot end with 8

---

5. Find the sum without actually adding the following odd numbers:
(i) 1 + 3 + 5 + 7 + ... + 35
Solution :

$1+3+5+7+.....+35 = \left[\frac{35+1}{2}\right]^2 = \left[\frac{36}{2}\right]^2$

$= 18^2$

$= 324$

(ii) The first 99 odd natural numbers.
Solution :

$1+3+5+7+.....+99$ odd natural numbers

$= 99^2$

$= 9801$

---

6. Express (i) 15^2 and (ii) 19^2 as the sum of two consecutive positive integers.
Solution :

(i) $15^2 = 225 = 112 + 113$

(ii) $19^2 = 361 = 180 + 181$

---

7. Write (i) 10^2 and (ii) 11^2 as the sum of consecutive odd natural numbers
Solution :

(i)

$10^2 = \left[\frac{20}{2}\right]2$

$= \left[\frac{19+1}{2}\right]2$

$= 1+3+5+.....+19$

(ii)

$11^2 = \left[\frac{22}{2}\right]2$

$= \left[\frac{21+1}{2}\right]2$

$= 1+3+5+.....+21$

---

8. Find a Pythagorean triplet whose
(i) largest member is 65 (ii) smallest member is 10
Solution :

Pythagorean triplet $(2m, m^2-1, m^2+1)$

(i) $m^2+1 = 65$

$m^2 = 65-1$

$m^2 = 64$

$m = 8$

$\therefore$ (16, 63, 65)

(ii) $2m = 10$

$m = 10/2 = 5$

$\therefore$ (10, 24, 26)

---

9. Find the square root of the following by repeated subtraction method.
(i) 144 (ii) 256 (iii) 784
Solution :

(i) 144 (Step)

1 : 144 - 1 = 143
2 : 143 - 3 = 140
3 : 140 - 5 = 135
4 : 135 - 7 = 128
5 : 128 - 9 = 119
6 : 119 - 11 = 108
7 : 108 - 13 = 95
8 : 95 - 15 = 80
9 : 80 - 17 = 63
10 : 63 - 19 = 44
11 : 44 - 21 = 23
12 : 23 - 23 = 0

$\therefore 144 = 12^2 \Rightarrow \sqrt{144} = 12$

(ii) 256 (Step)

1 : 256 - 1 = 255
2 : 255 - 3 = 252
3 : 252 - 5 = 247
4 : 247 - 7 = 240
5 : 240 - 9 = 231
6 : 231 - 11 = 220
7 : 220 - 13 = 207
8 : 207 - 15 = 192
9 : 192 - 17 = 175
10 : 175 - 19 = 156
11 : 156 - 21 = 135
12 : 135 - 23 = 112
13 : 112 - 25 = 87
14 : 87 - 27 = 60
15 : 60 - 29 = 31
16 : 31 - 31 = 0

$\therefore 256 = 16^2 \Rightarrow \sqrt{256} = 16$

(iii) 784 (Step)

1 : 784 - 1 = 783
2 : 783 - 3 = 780
3 : 780 - 5 = 775
4 : 775 - 7 = 768
5 : 768 - 9 = 759

6 : 759 - 11 = 748
7 : 748 - 13 = 735
8 : 735 - 15 = 720
9 : 720 - 17 = 703
10: 703 - 19 = 684
11: 684 - 21 = 663
12: 663 - 23 = 640
13: 640 - 25 = 615
14: 615 - 27 = 588
15: 588 - 29 = 559
16: 559 - 31 = 528
17: 528 - 33 = 495
18: 495 - 35 = 460
19: 460 - 37 = 423
20: 423 - 39 = 384
21: 384 - 41 = 343
22: 343 - 43 = 300
23: 300 - 45 = 255
24: 255 - 47 = 208
25: 208 - 49 = 159
26: 159 - 51 = 108
27: 108 - 53 = 55
28: 55 - 55 = 0

$\therefore 784 = 28^2 \Rightarrow \sqrt{784} = 28$

10. Find the square root by prime factorisation method.
(i) 1156 (ii) 4761 (iii) 9025
Solution :

(i) 1156

2	1156
2	578
17	289
17	17
	1

$\therefore \sqrt{1156} = \sqrt{2^2 \times 17^2}$
$= 2 \times 17 = 34$

(ii) 4761

3	4761
3	1587
23	529
23	23
	1

$\therefore \sqrt{4761} = \sqrt{3^2 \times 23^2}$
$= 3 \times 23 = 69$

(iii) 9025

5	9025
5	1805
19	361
19	19
	1

$\therefore \sqrt{9025} = \sqrt{5^2 \times 19^2}$
$= 5 \times 19 = 95$

11. Examine if each of the following is a perfect square:
(i) 725 (ii) 190 (iii) 841 (iv) 1089
Solution :

(i) 725

5	725
5	145
29	29
	1

$725 = 5^2 \times 29^1$
$\therefore$ It is not a perfect square

(ii) 190

2	190
5	95
19	19
	1

$190 = 2^1 \times 5^1 \times 19^1$
$\therefore$ It is not a perfect square

(iii) 841

29	841
29	29
	1

$841 = 29^2$
$\therefore$ It is a perfect square

(iv) 1089

3	1089
3	363
11	121
11	11
	1

$1089 = 3^2 \times 11^2$
$\therefore$ It is a perfect square

12. Find the least number by which 1800 should be multiplied so that it becomes a perfect square. Also, find the square root of the perfect square thus obtained.
Solution :

$1800 = 2^3 \times 3^2 \times 5^2$
$\therefore$ It should be multiplied by 2 to make it as a perfect square
$\therefore 1800 \times 2 = 3600 = 2^4 \times 3^2 \times 5^2$

2	1800
2	900
2	450
3	225
3	75
5	25
5	5
	1

$\sqrt{3600} = \sqrt{2^4 \times 3^2 \times 5^2}$
$= 2^2 \times 3^1 \times 5^1$
$= 2 \times 2 \times 3 \times 5$
$= 60$

13. Find the smallest number by which 10985 should be divided so that the quotient is a perfect square.

Solution :

5	10985
13	2197
13	169
13	13
	1

$10985 = 5^1 \times 13^3$

$= 5 \times 13 = 65$

∴ It should be divided by 65 to make it as a perfect square

---

14. Is 2352 a perfect square? If not, find the smallest number by which 2352 must be multiplied. so that the product is a perfect square. Find the square root of the new number.

Solution :

$2352 = 2^4 \times 3^1 \times 7^2$

∴ It should be multiplied by 3 to make it as a perfect square

2	2352
2	1176
2	588
2	294
3	147
7	49
7	7
	1

∴ $2352 \times 3 = 7056$

$\sqrt{7056} = \sqrt{2^4 \times 3^2 \times 7^2}$

$= 2 \times 2 \times 3 \times 7$

$= 84$

---

15. Find the least square number which is divisible by each of the numbers 8,12 and 15.

Solution :

$8 = 2^3$

$12 = 2^2 \times 3^1$

$15 = 3^1 \times 5^1$

∴ Least square number $= 2^4 \times 3^2 \times 5^2$

$= 2 \times 2 \times 2 \times 2 \times 3 \times 3 \times 5 \times 5$

$= 3600$

Think

1. Is the square of a prime number, prime?

Solution :

The square of a prime number is not a prime.

Ex. 7 is the prime number. But $7^2 = 49$

49 is not a prime number

---

2. Will the sum of two perfect squares, always a perfect square? What about their difference and their product?

Solution :

Sum of two perfect squares is not always a perfect square.

Ex. 16 and 25 are perfect squares. But their sum 16+25 = 41 is not a perfect square.

Difference of two perfect squares is not always a perfect square.

Ex. 36 and 25 are perfect squares. But their difference 36-25 = 11 is not a perfect square.

Product of two perfect squares is always a perfect square.

Ex. 4 and 9 are perfect squares. And their product 36 also a perfect square.

Try these

Consider the following square numbers:
(i) 441 (ii) 225 (iii) 289 (iv) 1089
Express each of them as the sum of two consecutive positive integers.

Solution :

(i) 441 = 220 + 221

(ii) 225 = 112 + 113

(iii) 289 = 144 + 145

(iv) 1089 = 544 + 545

Think

1. Take an even natural number, say, 46 (or any other even number of your choice). Try to express it as a sum of consecutive odd numbers starting with Do you succeed?

Solution :

We can write an even number as sum of consecutive odd numbers starting with 1

Ex. :

2 ≠ 1 6 ≠ 1+3+5 10 ≠ 1+3+5+7

4 = 1 +3 8 ≠ 1+3+5 12 ≠ 1+3+5+7

---

2. The square of an odd number can always be written as the sum of two consecutive natural numbers. Can the reverse statement be true? Is the sum of any two consecutive natural numbers a perfect square of a number?

Solution :

The square of an odd number can always be written as the sum of two consecutive natural number.

Ex. : $9 = 4+5$
$25 = 12+13$
$49 = 24+25$

But the reverse statement is not correct. Since $5 + 6 = 11$. But 11 is not a square of a odd number.

Try these

(i) Which among 256, 576, 960, 1025, 4096 are perfect square numbers?
(Hint: Try to extend the table of squares already seen).

Solution :

256 = 16^2 (Perfect square)
576 = 24^2 (Perfect square)
960 (Not a Perfect square)
1025 (Not a Perfect square)
4096 = 64^2 (Perfect square)

(ii) One can judge just by look, that the each of the following numbers: 82, 113, 2057, 24353, 8888, 1972 is not a perfect square. Explain why?

Solution :

Since numbers end with 2, 3, 7 and 8 are not a perfect square numbers.

(iii) Find the squares by diagonal method and also the ones digit in the squares of the following numbers: 11, 27, 42, 79, 146, 324, 520.

Solution :

11)

		1	1	x
0		0/1	0/1	1
1		0/1	0/1	1
		2	1	

$11^2 = 121$

---

27)

		2	7	x
0		0/4	1/4	2
7		1/4	4/9	7
		2	9	

$27^2 = 729$

---

42)

		4	2	x
1		1/6	0/8	4
7		0/8	0/4	2
		6	4	

$42^2 = 1764$

---

79)

	7	9	x
6	4/9	6/3	7
2	6/3	8/1	9
	4	1	

$79^2 = 6241$

146)

	1	4	6	x
0	0/1	0/4	0/6	1
2	0/4	1/6	2/4	4
1	0/6	2/4	3/6	6
	3	1	6	

$146^2 = 21316$

324)

	3	2	4	x
1	0/9	0/6	1/2	3
0	0/6	0/4	0/8	2
4	1/2	0/8	1/6	4
	9	7	6	

$324^2 = 104976$

520)

	5	2	0	x
2	2/5	1/0	0/0	5
7	1/0	0/4	0/0	2
0	0/0	0/0	0/0	0
	4	0	0	

$520^2 = 270400$

Think

Consider the claim: "Between the squares of the consecutive numbers n and $(n+1)$, there are $2n$ non-square numbers". Can it be true? How many non-square numbers are there between 2500 and 2601 and verify the claim.

Solution :

$2500 = 50^2$

$2601 = 51^2$

2501, 2502, ...2600 = 100 numbers.

$= 2(50)$

$= 2n$ numbers.

Activity

Verify the following statements:

(i) The square of a natural number, other than 1, is either a multiple of 3 or exceeds a multiple of 3 by 1.

Solution : True

$2^2 = 4 = 3 \times 1 + 1$

$3^2 = 9 = 3 \times 3 + 0$

$4^2 = 16 = 3 \times 5 + 1$

$5^2 = 25 = 3 \times 8 + 1$....

(ii) The square of a natural number, other than 1, is either a multiple of 4 or exceeds a multiple of 4 by 1.

Solution : True

$2^2 = 4 = 4 \times 1$

$3^2 = 9 = 4 \times 2 + 1$

$4^2 = 16 = 4 \times 4$

$5^2 = 25 = 4 \times 6 + 1$....

(iii) The remainder of a perfect square when divided by 3, is either 0 or 1 but never 2.

Solution : True

1	3	5	8
3 ⟌ 4	3 ⟌ 9	3 ⟌ 16	3 ⟌ 25
3	9	15	24
1	0	1	1

(iv) The remainder of a perfect square, when divided by 4, is either 0 or 1 but never 2 and 3.

Solution : True

1	2	4	6
4 ⟌ 4	4 ⟌ 9	4 ⟌ 16	4 ⟌ 25
4	8	16	24
0	1	0	1

(v) When a perfect square number is divided by 8, the remainder is either 0 or 1 or 4, but never be equal to 2, 3, 5, 6 or 7.

Solution : True

1	2	3	4
8 ⟌ 9	8 ⟌ 16	8 ⟌ 25	8 ⟌ 36
8	16	24	32
1	0	1	4

Activity

Consider any natural number $m > 1$. We find that $(2m, m^2, -1, m^2 + 1)$ will form a Pythagorean triplet. (A little algebra can help you to verify this!).

With this formula, generate a few Pythagorean triplets. One is done for you!

Now, we take $2m = 14$. Here, $2m$ has to be an even integer (why?).

$2m = 14 \Rightarrow (2m)^2 = 14^2 = 196$

This shows that,

$m^2-1 = 7^2 - 1 = 48 \Rightarrow (m^2-1)^2 = 48^2 = 2304$

$m^2+1 = 7^2+1 = 50 \Rightarrow (m^2+1)^2 = 50^2 = 2500$

$196 + 2304 = 2500$

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

Thus (14, 48, 50) is a Pythagorean triplet.

Try these

Use the method of successive subtraction of odd numbers (starting from 1) to examine the following numbers and find if they are perfect squares or not. For perfect square numbers that you find, identify the square root.

(i) 144 (ii) 256 (iii) 360

Solution :

(i) 144 (Step)

1 : 144 - 1 = 143
2 : 143 - 3 = 140
3 : 140 - 5 = 135
4 : 135 - 7 = 128
5 : 128 - 9 = 119
6 : 119 - 11 = 108
7 : 108 - 13 = 95
8 : 95 - 15 = 80
9 : 80 - 17 = 63
10 : 63 - 19 = 44
11 : 44 - 21 = 23
12 : 23 - 23 = 0

$144 = 12^2 \Rightarrow \sqrt{144} = 12$

∴ perfect square

(ii) 256 (Step)

1 : 256 - 1 = 255
2 : 255 - 3 = 252
3 : 252 - 5 = 247
4 : 247 - 7 = 240
5 : 240 - 9 = 231
6 : 231 - 11 = 220
7 : 220 - 13 = 207
8 : 207 - 15 = 192
9 : 192 - 17 = 175
10 : 175 - 19 = 156

11: 156 - 21 = 135
12: 135 - 23 = 112
13: 112 - 25 = 87
14: 87 - 27 = 60
15: 60 - 29 = 31
16: 31 - 31 = 0

$256 = 16^2 \Rightarrow \sqrt{256} = 16$
∴ perfect square

(iii) 360 (Step)
1 : 360 - 1 = 359
2 : 359 - 3 = 356
3 : 356 - 5 = 351
4 : 351 - 7 = 344
5 : 344 - 9 = 335
6 : 335 - 11 = 324
7 : 324 - 13 = 311
8 : 311 - 15 = 296
9 : 296 - 17 = 279
10: 279 - 19 = 260
11: 260 - 21 = 239
12: 239 - 23 = 216
13: 216 - 25 = 191
14: 191 - 27 = 164
15: 164 - 29 = 135
16: 135 - 31 = 104
17: 104 - 33 = 71
18: 71 - 35 = 36
19: 36 - 37 = -1 ≠ 0
∴ 360 is not a perfect square

Think

In this case, if we want to find the smallest factor with which we can multiply or divide 108 to get a square number, what should we do?

Solution :

We have to factor 108 by prime numbers and which one has no even powers. Here it is 3. Hence we have to divide or multiply by 3 to make it as perfect square.

2	108
2	54
3	27
3	9
3	3
	1

$108 = 2^2 \times 3^3$

Exercise 1.2

I. Fill in the blanks.

(i) If a number has 5 or 6 digits in it then, its square root will have _____ digits.

Solution :

3

(ii) The value of $\sqrt{180}$ lies between integers _____ and _____.

Solution :

13 and 14

(iii) $\sqrt{10} \times \sqrt{6} \times \sqrt{15}$ = _____

Solution :

$\sqrt{10} \times \sqrt{6} \times \sqrt{15} = \sqrt{900} = 30$

(iv) $\frac{\sqrt{300}}{\sqrt{192}}$ = _____

Solution :

$\frac{\sqrt{300}}{\sqrt{192}} = \frac{\sqrt{100}}{\sqrt{64}} = \frac{10}{8} = \frac{5}{4}$

(v) $\sqrt{65.61}$ = _____

Solution :

$\sqrt{65.61} = \frac{\sqrt{6561}}{\sqrt{100}} = \frac{81}{10} = 8.1$

2. Estimate the value of the following square roots to the nearest whole number:

(i) $\sqrt{440}$ (ii) $\sqrt{800}$ (iii) $\sqrt{1020}$

Solution :

(i) $\sqrt{440}$ = 21 ($\sqrt{441}$ = 21)

(ii) $\sqrt{800}$ = 28 ($\sqrt{784}$ = 28)

(iii) $\sqrt{1020}$ = 32 ($\sqrt{1024}$ = 32)

3. Find the least number that must be added to 1300 so as to get a perfect square. Also, find the square root of the perfect square.

Solution :

$36^2 = 1296$

$37^2 = 1369$

∴ **1300 + 69 = 1369**

We have to add 69 to 1300 to get a perfect square.

$\sqrt{1369} = 37$

---

4. Find the least number that must be subtracted to 6412 so as to get a perfect square. Also find the square root of the perfect square.

Solution :

$6400 = 80^2$

∴ We have to subtract 12 from 6412 to get a perfect square.

$\sqrt{6400} = 80$

---

5. Find the square root by long division method.

(i) 17956 (ii) 11025 (iii) 6889

(iv) 1764 (v) 418609

Solution :

(i) 17956

```
        134
    1 | 179 56
      | 1
      |-----
      | 079
   23 |  69
      |-----
  264 | 1056
      | 1056
      |-----
      |    0
```

∴ $\sqrt{17956} = 134$

(ii) 11025

```
        105
    1 | 1 10 25
      | 1
      |-------
      | 01025
  205 | 1025
      |------
      |    0
```

∴ $\sqrt{11025} = 105$

(iii) 6889

```
        83
    8 | 68 89
      | 64
      |-----
  163 | 489
      | 489
      |-----
      |   0
```

∴ $\sqrt{6889} = 83$

(iv) 1764

```
        42
    4 | 17 64
      | 16
      |-----
   82 | 164
      | 164
      |-----
      |   0
```

∴ $\sqrt{1764} = 42$

(v) 418609

```
        647
    6 | 41 86 09
      | 36
      |-------
  124 | 586
      | 496
      |-------
 1287 | 9009
      | 9009
      |-------
      |    0
```

∴ $\sqrt{418609} = 647$

---

6. Find the square root of the following decimal numbers:

(i) 2.89 (ii) 1.96 (iii) 67.24

(iv) 31.36 (v) 2.0164 (vi) 13.987

Solution :

(i) $\sqrt{2.89} = \sqrt{\frac{289}{100}} = \sqrt{\frac{17^2}{2^2 \times 5^2}} = \frac{17}{2 \times 5}$

$= \frac{17}{10} = 1.7$

(ii) $\sqrt{1.96} = \sqrt{\frac{196}{100}} = \sqrt{\frac{2^2 \times 7^2}{2^2 \times 5^2}} = \frac{2 \times 7}{2 \times 5}$

$= \frac{14}{10} = 1.4$

(iii) $\sqrt{67.24} = \sqrt{\frac{6724}{100}} = \sqrt{\frac{2^2 \times 41^2}{2^2 \times 5^2}} = \frac{2 \times 41}{2 \times 5}$

$= \frac{84}{10} = 8.4$

(iv) $\sqrt{31.36} = \sqrt{\frac{3136}{100}} = \sqrt{\frac{2^6 \times 7^2}{2^2 \times 5^2}} = \frac{2^3 \times 7}{2 \times 5}$

$= \frac{8 \times 7}{10} = \frac{56}{10} = 5.6$

(v) $\sqrt{2.0164} = \sqrt{\frac{20164}{10000}} = \sqrt{\frac{2^2 \times 71^2}{2^4 \times 5^4}} = \frac{2 \times 71}{2^2 \times 5^2}$

$= \frac{142}{100} = 1.42$

(vi) $\sqrt{13.9876} = \sqrt{\frac{139876}{10000}} = \sqrt{\frac{2^2 \times 11^2 \times 17^2}{2^4 \times 5^4}}$

$= \frac{2 \times 11 \times 17}{2^2 \times 5^2} = \frac{374}{100} = 3.74$

7. Find the square root of each of the following fractions:

(i) $\frac{144}{225}$ **(ii)** $7\frac{18}{49}$ **(iii)** $6\frac{1}{4}$ **(iv)** $4\frac{25}{36}$

Solution:

(i) $\sqrt{\frac{144}{225}} = \sqrt{\frac{12^2}{15^2}} = \frac{12}{15}$

(ii) $\sqrt{7\frac{18}{49}} = \sqrt{\frac{361}{49}} = \sqrt{\frac{19^2}{7^2}} = \frac{19}{7} = 2\frac{5}{7}$

(iii) $\sqrt{6\frac{1}{4}} = \sqrt{\frac{25}{4}} = \sqrt{\frac{5^2}{2^2}} = \frac{5}{2} = 2\frac{1}{2}$

(iv) $\sqrt{4\frac{25}{36}} = \sqrt{\frac{169}{36}} = \sqrt{\frac{13^2}{6^2}} = \frac{13}{6} = 2\frac{1}{6}$

8. Say True or False:

(i) $\frac{\sqrt{32}}{\sqrt{8}} = 2$ **(ii)** $\sqrt{\frac{625}{1024}} = \frac{25}{32}$

(iii) $\sqrt{28} \times \sqrt{7} = 2\sqrt{7}$ **(iv)** $\sqrt{225} + \sqrt{64} = \sqrt{289}$

(v) $\sqrt{1\frac{400}{441}} = 1\frac{20}{21}$

Solution:

(i) $\frac{\sqrt{32}}{\sqrt{8}} = \sqrt{\frac{32}{8}} = \sqrt{4} = 2$ (True)

(ii) $\sqrt{\frac{625}{1024}} = \sqrt{\frac{25^2}{32^2}} = \frac{25}{32}$ (True)

(iii) $\sqrt{28} \times \sqrt{7} = \sqrt{2 \times 2 \times 7 \times 7}$

$= 2 \times 7 = 14 \neq 2\sqrt{7}$

(False)

(iv) $\sqrt{225} + \sqrt{64} = \sqrt{15^2} + \sqrt{8^2}$

$= 15 + 8 = 23$

$\sqrt{289} = \sqrt{17^2} = 17$ (False)

(v) $\sqrt{1\frac{400}{441}} = \sqrt{\frac{841}{441}} = \sqrt{\frac{29^2}{21^2}}$

$\frac{29}{21} = 1\frac{9}{21} \neq 1\frac{20}{21}$ (False)

Objective Type Questions

9. $\sqrt{48}$ is approximately equal to

(a) 5 (b) 6 (c) 7 (d) 8

Solution:

(c) 7

10. $\sqrt{128} - \sqrt{98} + \sqrt{18} =$

(a) $\sqrt{2}$ **(b)** $\sqrt{8}$ **(c)** $\sqrt{48}$ **(d)** $\sqrt{32}$

Solution: (d) $\sqrt{32}$

Hint: $\sqrt{128} - \sqrt{98} + \sqrt{18}$

$= \sqrt{64 \times 2} - \sqrt{49 \times 2} + \sqrt{9 \times 2}$

$= 8\sqrt{2} - 7\sqrt{2} + 3\sqrt{2}$

$= 11\sqrt{2} - 7\sqrt{2} = 4\sqrt{2}$

$= \sqrt{4 \times 4 \times 2} = \sqrt{32}$

---

11. $\sqrt{22 + \sqrt{7 + \sqrt{4}}} =$

(a) $\sqrt{25}$ **(b)** $\sqrt{33}$ **(c)** $\sqrt{31}$ **(d)** $\sqrt{29}$

Solution: (a) $\sqrt{25}$

$\sqrt{22 + \sqrt{7 + \sqrt{4}}} = \sqrt{22 + \sqrt{7+2}}$

$= \sqrt{22 + \sqrt{9}}$

$= \sqrt{22+3}$

$= \sqrt{25}$

---

12. The number of digits in the square root of 123454321 is
(a) 4 (b) 5 (c) 6 (d) 7

Solution:
(b) 5

Try these

Find the square root by long division method.
(i) 400 (ii) 1764 (iii) 4356

Solution:

(i) 400

$$\begin{array}{r|l} & 20 \\ \hline 2 & 4\,00 \\ & 4 \\ \hline 40 & 00 \\ & 00 \\ \hline & 0 \end{array}$$

$\therefore \sqrt{400} = 20$

(ii) 1764

$$\begin{array}{r|l} & 42 \\ \hline 4 & 17\,64 \\ & 16 \\ \hline 82 & 164 \\ & 164 \\ \hline & 0 \end{array}$$

$\therefore \sqrt{1764} = 42$

(iii) 4356

$$\begin{array}{r|l} & 66 \\ \hline 6 & 43\,56 \\ & 36 \\ \hline 126 & 756 \\ & 756 \\ \hline & 0 \end{array}$$

$\therefore \sqrt{4356} = 66$

Try these

Without calculating the square root, guess the number of digits in the square root of the following numbers:
(i) 14400 (ii) 100000000 (iii) 390625

Solution:

(i) $14400 = \sqrt{144} \times \sqrt{100} = 12 \times 10 = 120 = 3$

(ii) $100000000 = \sqrt{10000} \times \sqrt{10000} = 100 \times 100$
$= 10000 = 5$

(iii) $390625 = \sqrt{25 \times 25 \times 25 \times 25}$

$= \sqrt{25 \times 25} \times \sqrt{25 \times 25} = 25 \times 25 = 625 = 3$

Try these

Find the square root of
(i) 19.36 (ii) 1.2321 (iii) 116.64

Solution:

(i) 19.36

$$\sqrt{19.36} = \sqrt{\frac{1936}{100}} = \sqrt{\frac{2^4 \times 11^2}{2^2 \times 5^2}} = \frac{2^2 \times 11}{2 \times 5}$$

$$= \frac{44}{10} = 4.4$$

(ii) $\sqrt{1.2321} = \sqrt{\frac{12321}{10000}} = \sqrt{\frac{3^2 \times 37^2}{2^4 \times 5^4}} = \frac{3 \times 37}{2^2 \times 5^2}$

$= \frac{111}{100} = 1.11$

(iii) $\sqrt{116.64} = \sqrt{\frac{11664}{100}} = \sqrt{\frac{2^4 \times 3^6}{2^2 \times 5^2}} = \frac{2^2 \times 3^3}{2 \times 5}$

$= \frac{108}{10} = 10.8$

Think.
Fill in the table.

$\sqrt{36}=6$	$\sqrt{9}\times\sqrt{4}=3\times2=6$	Is $\sqrt{36}=\sqrt{9}\times\sqrt{4}$? Yes 3 x 2 = 6	$\sqrt{81}=?$ 9	$\sqrt{9}\times\sqrt{9}=\_3\_\times\_3\_=\_9\_$	Is $\sqrt{81}=\sqrt{9}\times\sqrt{9}$? Yes 3 x 3 = 9
$\sqrt{144}=?$	$\sqrt{9}\times\sqrt{16}=\_3\_\times\_4\_=\_12\_$	Is $\sqrt{144}=\sqrt{9}\times\sqrt{16}$? Yes 3x 4 =12	$\sqrt{144}=?$ 12	$\sqrt{36}\times\sqrt{4}=\_6\_\times\_2\_=\_12\_$	Is $\sqrt{144}=\sqrt{36}\times\sqrt{4}$? Yes 6 x 2 = 12
$\sqrt{100}=?$	$\sqrt{25}\times\sqrt{4}=\_5\_\times\_2\_=\_10\_$	Is $\sqrt{100}=\sqrt{25}\times\sqrt{4}$? Yes 5x2 =10	$\sqrt{1225}=?$ 35	$\sqrt{25}\times\sqrt{49}=\_5\_\times\_7\_=\_35\_$	Is $\sqrt{1225}=\sqrt{25}\times\sqrt{49}$? Yes 5 x 7 = 35

Activity

Attempt to prepare a table of square root problems as in the above case to show that if *a* and *b* are two perfect square numbers, then $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ $(b \neq 0)$

We can use this idea to compute easily certain square-root problems.
Solution :

$\sqrt{\frac{25}{49}} = \frac{\sqrt{25}}{\sqrt{49}} = \frac{\sqrt{5^2}}{7^2} = \frac{5}{7}$

Try these

Using the above method, find the square root of 1.2321 and 11.9025.
Solution :

$\sqrt{1.2321} = \sqrt{\frac{12321}{10000}} = \sqrt{\frac{3^2 \times 37^2}{100}} = \frac{3 \times 37}{100}$

$= \frac{111}{100} = 1.11$

$\sqrt{11.9025} = \sqrt{\frac{119025}{10000}} = \sqrt{\frac{3^2 \times 5^2 \times 23^2}{100}}$

$= \frac{3 \times 5 \times 23}{100} = \frac{345}{100} = 3.45$

Try these

Put the numbers (i) 4, $\sqrt{14}$, 5 and

(ii) 7, $\sqrt{65}$, 8 in ascending order.

Solution :

(i) $\sqrt{14}$, 4, 5

(ii) 7, 8, $\sqrt{65}$

Exercise 1.3

I. Fill in the blanks:

(i) The ones digits in the cube of 73 is_____.

Solution :

7

(ii) The maximum number of digits in the cube of a two digit number is _____.

Solution :

6

(iii) The cube root of 540x50 is _____.

Solution :

$\sqrt[3]{540 \times 50} = \sqrt[3]{27000} = 30$

(iv) The cube root of 0.000004913 is _____.

Solution :

$\sqrt[3]{0.000004913} = 0.017$

(v) The smallest number to be added to 3333 to make it a perfect cube is _____.

Solution :

$\sqrt[3]{3333+42} = \sqrt[3]{3375} = 42$

---

2. Say True or False:

(i) The cube of 0.0012 is 0.000001728.

Solution : False

(ii) The cube root of 250047 is 63.

Solution : True

(iii) 79570 is not a perfect cube.

Solution : True

---

3. Show that 1944 is not a perfect cube.

Solution :

$1944 = 2^3 \times 3^5$

∴ It is not a perfect cube

2	1944
2	972
2	486
3	243
3	81
3	27
3	9
3	3
	1

---

4. Find the cube root of 24 x 36 x 80 x 25.

Solution :

$24 \times 36 \times 80 \times 25 = 2^9 \times 3^3 \times 5^3$

2	24	2	36	2	80	5	25
2	12	2	18	2	40	5	5
2	6	3	9	2	20		1
3	3	3	3	2	10		
	1		1	5	5		
					1		

$\sqrt[3]{24 \times 36 \times 80 \times 25} = \sqrt[3]{2^9 \times 3^3 \times 5^3}$

$= 2^{3 \times} 3^1 \times 5^1 = 120$

---

5. Find the smallest number by which 10985 should be divided so that the quotient is a perfect cube.

Solution :

5	10985
13	2197
13	169
13	13
	1

$10985 = 5^1 \times 13^3$

∴ It should be divided by 5. So that the quotient is a perfect cube.

---

6. Find two smallest perfect square numbers which when multiplied together gives a perfect cube number.

Solution :

4 and 16 are the two smallest perfect square numbers multiplied together gives 64 whose cube root is 4

7. If the cube of a squared number is 729, find the square root of that number.

Solution :

$\sqrt[3]{729} = \sqrt[3]{3^6}$

$= 3^2 = 9$

$= \sqrt{9} = \sqrt{3^2} = 3$

3	729
3	243
3	81
3	27
3	9
3	3
	1

8. What is the square root of cube root of 46656?

Solution :

$\sqrt[3]{46656} = \sqrt[3]{2^6 \times 3^6}$

$= 2^2 \times 3^2 = 36$

$\sqrt{36} = \sqrt{2^2 \times 3^2} = 2 \times 3 = 6$

2	46656
2	23328
2	11664
2	5832
2	2916
2	1458
3	729
3	243
3	81
3	27
3	9
3	3
	1

9. Find the cube root of 729 and 6859 by prime factorisation.

Solution :

$\sqrt[3]{729} = \sqrt[3]{3^6}$

$= 3^2 = 9$

$\sqrt[3]{6859} = \sqrt[3]{19^3}$

$= 19$

3	729
3	243
3	81
3	27
3	9
3	3
	1

19	6859
19	361
	19

10. Find the smallest number by which 200 should be multiplied to make it perfect cube

Solution :

$200 = 2^3 \times 5^2$

∴ It should be multiplied by 5 to make it as a perfect cube.

2	200
2	100
2	50
5	25
5	5
	1

Try these

Find the ones digit in the cubes of each of the following numbers.

(i) 17 (ii) 12 (iii) 38

(iv) 53 (v) 71 (vi) 84

Solution :

(i) 3
(ii) 8
(iii) 2
(iv) 7
(v) 1
(vi) 4

Think

If in the above question, the word 'multiplied' is replaced by the word 'divided', how will the solution vary?

Solution :

$675 = 3^3 \times 5^2$

When divided by 25 we can get 27. Then its cube root is 3

When it is multiplied by 5 we can get 3375 then its cube root is 15.

Exercise 1.4

I. Fill in the blanks:

(i) $(-1)^{\text{even integer}}$ is _____.

Solution : 1

(ii) For $a \neq 0$, a^o is _____

Solution : 1

(iii) $4^{-3} \times 5^{-3}$ = _____.

Solution :

20^{-3} [$4^{-3} \times 5^{-3} = (4 \times 5)^{-3} = 20^{-3}$]

(iv) $(-2)^{-7}$ = _____.

Solution :

$-\frac{1}{128}$ $\left[(-2)^{-7} = \frac{1}{(-2)^7} = -\frac{1}{128}\right]$

(v) $\left(-\frac{1}{3}\right)^{-5}$ = _____.

Solution :

-243 $\left[\left(-\frac{1}{3}\right)^{-5} = (-3)^5 = -243\right]$

---

2. Say True or False:

(i) If $8^x = \frac{1}{64}$, the value of, x is -2.

Solution :

True

$8^x = \frac{1}{64} = 8^{-2} \Rightarrow x = -2$

(ii) The simplified form of $(256)^{\frac{-1}{4}}$ is $\frac{1}{4}$

Solution :

True

$\left[(256)^{\frac{-1}{4}} = (4^4)^{\frac{-1}{4}} = 4^{-1} = \frac{1}{4}\right]$

(iii) The standard form of $2x10^{-4}$ is 0.0002.

Solution :

True

(iv) The scientific form of 123.456 is 1.23456×10^{-2}.

Solution :

False

$[123.456 = 1.23456\times10^{2}]$

(v) The multiplicative inverse of 3^{-7} is 3^7 .

Solution :

True

---

3. Evaluate:

(i) $\left(\frac{1}{2}\right)^3$ (ii) $\left(\frac{1}{2}\right)^{-5}$ (iii) (-3) (iv) $(-3)^4$

(v) $\left(\frac{-5}{6}\right)^{-3}$ (vi) $(2^{-5} \div 2^7)\times2^{-2}$

(vii) $(2^{-1}\times3^{-1})\div6^{-2}$ (viii) $\left(-\frac{1}{3}\right)^{-2}$

Solution :

(i) $\left(\frac{1}{2}\right)^3 = \frac{1}{2}\times\frac{1}{2}\times\frac{1}{2} = \frac{1}{8}$

(ii) $\left(\frac{1}{2}\right)^{-5} = (2)^5 = 2\times2\times2\times2\times2 = 32$

(iii) $(-3) = -3$

(iv) $(-3)^4 = (-3)\times(-3)\times(-3)\times(-3) = 81$

(v) $\left(-\frac{5}{6}\right)^{-3} = \left(-\frac{6}{5}\right)^3 = \left(-\frac{6}{5}\right)\times\left(-\frac{6}{5}\right)\times\left(-\frac{6}{5}\right)$

$= -\frac{216}{125}$

(vi) $(2^{-5} \div 2^7)\times2^{-2}$

$= \left(\frac{2^{-5}}{2^7}\right)\times2^{-2} = 2^{-12}\times2^{-2} = 2^{-14}$

(vii) $(2^{-1}\times3^{-1})\div6^{-2}$

$= \left(\frac{1}{2}\times\frac{1}{3}\right)\div\left(\frac{1}{6^2}\right) = \frac{1}{6}\times\frac{6^2}{1} = 6$

(viii) $\left(-\frac{1}{3}\right)^{-2} = (-3)^2 = (-3)\times(-3) = 9$

---

4. Evaluate:

(i) $\left(\frac{2}{5}\right)^4 \times \left(\frac{2}{5}\right)^2$ (ii) $\left(\frac{4}{5}\right)^{-2} \times \left(\frac{4}{5}\right)^{-3}$

(iii) $\left(\frac{1}{2}\right)^{-3} \times \left(\frac{1}{2}\right)^7$

Solution:

(i) $\left(\frac{2}{5}\right)^4 \times \left(\frac{2}{5}\right)^2 = \left(\frac{2}{5}\right)^{4+2} = \left(\frac{2}{5}\right)^6$

(ii) $\left(\frac{4}{5}\right)^{-2} \times \left(\frac{4}{5}\right)^{-3} = \left(\frac{4}{5}\right)^{-2-3} = \left(\frac{4}{5}\right)^{-5}$

(iii) $\left(\frac{1}{2}\right)^{-3} \times \left(\frac{1}{2}\right)^7 = \left(\frac{1}{2}\right)^{-3+7} = \left(\frac{1}{2}\right)^4$

---

5. Evaluate:

(i) $(5^0+6^{-1}) \times 3^3$ (ii) $(2^{-1} \times 3^{-1}) \div 6^{-1}$

(iii) $(3^{-1}+4^{-2}+5^{-3})^0$

Solution:

(i) $(5^0+6^{-1}) \times 3^3$

$= \left(1+\frac{1}{6}\right) \times (3 \times 3 \times 3)$

$= \frac{7}{\cancel{6}_2} \times \cancel{27}^9 = \frac{63}{2}$

(ii) $(2^{-1} \times 3^{-1}) \div 6^{-1}$

$= \left(\frac{1}{2} \times \frac{1}{3}\right) \div \left(\frac{1}{6}\right)$

$\frac{1}{\cancel{6}} \times \frac{\cancel{6}}{1} = 1$

(iii) $(3^{-1}+4^{-2}+5^{-3})^0$

$= 1$

$\left[\because\ a^\circ = 1\right]$

---

6. Simplify:

(i) $(3^2)^3 \times (2 \times 3^5)^{-2} \times (18)^2$

(ii) $\frac{9^2 \times 7^3 \times 2^5}{84^3}$ (iii) $\frac{2^{-8} \times 4^2 \times 3^5}{3^7 \times 2^5}$

Solution:

(i) $(3^2)^3 \times (2 \times 3^5)^{-2} \times (18)^2$

$= 3^6 \times \frac{1}{(2 \times 3^5)^2} \times (2 \times 3^2)^2$

$= 3^6 \times \frac{1}{2^2 \times 3^{10}} \times 2^2 \times 3^4$

$= \frac{2^2 \times 3^{10}}{2^2 \times 3^{10}} = 2^0 \times 3^0 = 1$

2	18
3	9
3	3
	1

$18 = 2 \times 3^2$

(ii) $\frac{9^2 \times 7^3 \times 2^5}{84^3}$

$= \frac{(3^2)^2 \times 7^3 \times 2^5}{(2^2 \times 3^1 \times 7^1)^3} = \frac{3^4 \times 7^3 \times 2^5}{2^6 \times 3^3 \times 7^3}$

$= \frac{3^{4-3} \times 7^{3-3}}{2^{6-5}} = \frac{3^1 \times 7^0}{2^1} = \frac{3}{2}$

2	84
2	42
3	21
7	7
	1

$84 = 2^2 \times 3^1 \times 7^1$

(iii) $\frac{2^{-8} \times 4^2 \times 3^5}{3^7 \times 2^5}$

$= \frac{2^{-8} \times (2^2)^2 \times 3^5}{3^7 \times 2^5} = \frac{2^{-8} \times 2^4 \times 3^5}{3^7 \times 2^5}$

$= \frac{2^{-8+4} \times 3^5}{2^5 \times 3^7} = \frac{2^{-4} \times 3^5}{2^5 \times 3^7}$

$= \frac{2^{-4-5}}{3^{7-5}} = \frac{2^{-9}}{3^2}$

---

7. Solve for x.

(i) $\frac{10^x}{10^{-3}} = 10^9$ (ii) $\frac{2^{2x-1}}{2^{x+2}} = 4$

(iii) $\frac{5^5 \times 5^{-4} \times 5^x}{5^{12}} = 5^{-5}$

Solution :

(i) $\frac{10^x}{10^{-3}} = 10^9$

$10^{x-(-3)} = 10^9$

$10^{x+3} = 10^9$

$\therefore x+3 = 9$

$x = 9-3 = 6$

(ii) $\frac{2^{2x-1}}{2^{x+2}} = 4$

$= 2^{(2x-1)-(x+2)} = 2^2$

$= 2^{2x-1-x-2} = 2^2$

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

$\therefore x-3 = 2$

$x = 2+3 = 5$

(iii) $\frac{5^5 \times 5^{-4} \times 5^x}{5^{12}} = 5^{-5}$

$= 5^{5-4+x-12} = 5^{-5}$

$= 5^{x-11} = 5^{-5}$

$\therefore x-11 = -5$

$x = -5+11 = 6$

---

8. Expand using exponents:
(i) 6054.321 (ii) 897.14
Solution :

(i) $6054.321 = 6\times10^3+5\times10^1+4\times10^0 + 3\times10^{-1}+2\times10^{-2}+1\times10^{-3}$

(ii) $897.14 = 8\times10^2+9\times10^1+7\times10^0 + 1\times10^{-1}+4\times10^{-2}$

---

9. Find the number is standard form:
(i) $8\times10^4+7\times10^3+6\times10^2+5\times10^1+2\times1 + 4\times10^{-2}+7\times10^{-4}$
(ii) $5\times10^3+5\times10^1+5\times10^{-1}+5\times10^{-3}$

Solution :
(i) $8\times10^4+7\times10^3+6\times10^2+5\times10^1+2\times1 + 4\times10^{-2}+7\times10^{-4}$
$= 87652.0407$

(ii) $5\times10^3+5\times10^1+5\times10^{-1}+5\times10^{-3}$
$= 5050.505$

---

10. The radius of a hydrogen atom is 2.5×10^{-11}m . Express this number in standard notation.
Solution :
$2.5\times10^{-11} = 0.000000000025$

---

11. Write the following numbers in scientific notation:
(i) 467800000000 (ii) 0.000001972
Solution :
(i) $467800000000 = 4.678\times10^{11}$

(ii) $0.000001972 = 1.972\times10^{-6}$

---

12. Write in scientific notation:
(i) Earth's volume is about 1,083,000,000,000 cubic kilometres.
(ii) If you fill a bucket with dirt, the portion of the whole Earth that is in the bucket will be 0.000000000000000000000016 kg.
Solution :
(i) $1,083,000,000,000 = 1.083\times10^{12}$ cubic km
(i) $0.000000000000000000000016 = 1.6\times10^{-24}$ kg

Objective Type Questions

13. By what number should $(-4)^{-1}$ be multiplied so that the product becomes 10^{-1}?

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

Solution : b) $\frac{-2}{5}$

Hint:

$(-4)^{-1}(x) = 10^{-1}$

$\left(-\frac{1}{4}\right)^{1}(x) = \frac{1}{10}$

$\left(-\frac{1}{2^2}\right)(x) = \left(\frac{1}{2x5}\right)$

$x = \left(\frac{1}{2x5}\right)\left(\frac{-2^2}{1}\right)$

$x = -\frac{2^{2-1}}{5}$

$x = -\frac{2}{5}$

---

14. 0.0000000002020 in scientific form is

a) $2.02x10^{9}$ c) $2.02x10^{-9}$
c) $2.02x10^{-8}$ d) $2.02x10^{-10}$

Solution:

d) $2.02x10^{-10}$

---

15. $(-2)^{-3}x(-2)^{-2}$ is.

a) $\frac{-1}{32}$ b) $\frac{1}{32}$ c)32 d)-32

Solution: a) $\frac{-1}{32}$

Hint:

$(-2)^{-3}x(-2)^{-2} = (-2)^{-5} = \frac{1}{(-2)^5} = -\frac{1}{32}$

---

16. Which is not correct?

a) $\left(\frac{-1}{4}\right)^{2} = 4^{-2}$ **b)** $\left(\frac{-1}{4}\right)^{2} = \left(\frac{1}{2}\right)^{4}$

c) $\left(\frac{-1}{4}\right)^{2} = 16^{-1}$ **d)** $-\left(\frac{1}{4}\right)^{2} = 16^{-1}$

Solution:

d) $-\left(\frac{1}{4}\right)^{2} = 16^{-1}$

$\left[\because -\left(\frac{1}{4}\right)^{2} = -\frac{1}{16} = -16^{-1}\right]$

---

17. If $\left(\frac{p}{q}\right)^{1-3x} = \left(\frac{q}{p}\right)^{1/2}$, then x is

a) 4^{-1} b) 3^{-1} c) 2^{-1} d) 1^{-1}

Solution: c) 2^{-1}

Hint:

$\left(\frac{p}{q}\right)^{1-3x} = \left(\frac{q}{p}\right)^{1/2} = \left(\frac{p}{q}\right)^{1-3x} = \left(\frac{p}{q}\right)^{-1/2}$

$\therefore 1-3x = -\frac{1}{2}$

$2-6x = -1$

$-6x = -1-2$

$x = \frac{-3}{-6}$

$x = \frac{1}{2}$

$x = 2^{-1}$

Try these

Expand the following numbers using exponents:

(i) 8120 (ii) 20,305
(iii) 3652.01 (iv) 9426.521

Solution:

(i) $8120 = 8x10^{3}+1x10^{2}+2x10^{1}$

(ii) $20.305 = 2x10^{1}+3x10^{-1}+5x10^{-3}$

(iii) $3652.01 = 3x10^{3}+6x10^{2}+5x10^{1}+2x10^{0}+1x10^{-2}$

(iv) $9426.521 = 9x10^{3}+4x10^{2}+2x10^{1}+6x10^{0}+5x10^{-1}+2x10^{-2}+1x10^{-3}$

Try these

Verify the following rules (as we did above). Here, a, b are non-zero integers and m, n are any integers.

1. Zero exponent rule: $a^0 = 1$.

2. Product of same powers to power of product rule: $a^m \times b^m = (ab)^m$

3. Quotient of same powers to power of quotient rule: $\frac{a^m}{b^m} = \left(\frac{a}{b}\right)^m$

Solution :

1) $5^0 = 1$

2) $2^3 \times 3^3 = (2\times3)^3 = 6^3$

3) $\frac{2^3}{3^3} = \left(\frac{2}{3}\right)^3$

Try these

1. Write in standard form: Mass of planet Uranus is 8.68×10^{25} Kg.

2. Write in scientific form:
(i) 0.000012005 (ii) 4312.345 (iii) 0.10524 (iv)The distance between the Sun and the planet Saturn 1.4335×10^{12} miles.

Solution :

1) 8.68×10^{25}

$= 86,800,000,000,000,000,000,000,000$ Kg

2) (i) $0.000012005 = 1.2005 \times 10^{-5}$

(ii) $4312.345 = 4.312345 \times 10^3$

(iii) $0.10524 = 1.0524 \times 10^{-1}$

(iv) $1.4335 \times 10^{12} = 1,433,500,000,000$ miles

Exercise 1.5
Miscellaneous and Practice Problems

1. A square carpet covers an area of 1024 m^2 of a big hall. It is placed in the middle of the hall. What is the length of a side of the carpet?

Solution :

Length of a side of the carpet $= \sqrt{1024}$

$= \sqrt{2^{10}}$

$= 2^5$

$= 2\times2\times2\times2\times2$

$= 32$ m

2	1024
2	512
2	256
2	128
2	64
2	32
2	16
2	8
2	4
2	2
	1

---

2. There is a large square portrait of a leader that covers an area of 4489 cm^2. If each side has a 2 cm liner, what would be its area?

Solution :

Length of side of square portrait $= \sqrt{4489}$

$= \sqrt{67^2}$

$= 67$ cm

67	4489
67	67
	1

Length of the liner $= 67 \text{ cm} + 4 \text{ cm} = 71$ cm

Area of the liner $= 71^2 - 4489$

$= 5041 - 4489$

$= 552 \text{ cm}^2$

---

3. 2401 plants are planted in a garden such that each contains as many plants as the number of rows. Find the number of rows and the number of plants in each row.

Solution :

Number of rows and number of plants

$= \sqrt{2401}$

$= \sqrt{7^4} = 7^2 = 7\times7 = 49$

7	2401
7	343
7	49
7	7
	1

4. If $\sqrt[3]{1906624} \times \sqrt{x} = 3100$, find x

Solution :

$\sqrt[3]{1906624} \times \sqrt{x} = 3100$

$\sqrt[3]{2^6 \times 31^3} \times \sqrt{x} = 3100$

$2^2 \times 31^1 \times \sqrt{x} = 3100$

$124 \times \sqrt{x} = 3100$

$\sqrt{x} = \frac{3100}{124}$

$\sqrt{x} = 25$

$x = 25^2 = 25 \times 25 = 625$

2	1906624
2	953312
2	476656
2	238328
2	119164
2	59582
31	29791
31	961
31	31
	1

5. If $(625)^x = 15625$, find x^2 and x^3

Solution :

$(625)^x = 15625$

$(5^4)^x = 5^6$

$5^{4x} = 5^6$

$\therefore 4x = 6$

$x = \frac{6}{4} = \frac{3}{2}$

5	15625
5	3125
5	625
5	125
5	25
5	5
	1

$x^2 = \left(\frac{3}{2}\right)^2 = \left(\frac{3}{2}\right)\left(\frac{3}{2}\right) = \frac{9}{4}$

$x^3 = \left(\frac{3}{2}\right)^3 = \left(\frac{3}{2}\right)\left(\frac{3}{2}\right)\left(\frac{3}{2}\right) = \frac{27}{8}$

6. If $2^{m-1} + 2^{m+1} = 640$, then find m.

Solution :

$2^{m-1} + 2^{m+1} = 640$

$2^{m-1} + 2^{m+1} = 128 + 512$

$2^{m-1} + 2^{m+1} = 2^7 + 2^9$

$\therefore m - 1 = 7$

$m = 7 + 1 = 8$

Hint : (Powers of 2 are 2, 4, 8, 16, 32, 64, 128, 256, 512)

7. Simplify:

$$\frac{16 \times 10^2 \times 64}{4^2 \times 2^4}$$

Solution :

$$\frac{16 \times 10^2 \times 64}{4^2 \times 2^4} = \frac{2^4 \times (2\times5)^2 \times 2^6}{(2^2)^2 \times 2^4}$$

$$= \frac{2^4 \times 2^2 \times 5^2 \times 2^6}{2^4 \times 2^4} = \frac{2^{4+2+6} \times 5^2}{2^8}$$

$$= \frac{2^{12} \times 5^2}{2^8} = 2^{12-8} \times 5^2$$

$= 2^4 \times 5^2 = 16 \times 25 = 400$

8. Give the answer in scientific notation:
A human heart beats at an average of 80 beats per minute. How many times does it beat in
i) an hour? ii) a day?
iii) a year? iv) 100 years?

Solution :

Heart beat = 80 beats / min

(i) An hour $= 80 \times 60 = 4800$
$= 4.8 \times 10^3$

(ii) In a day $= 4800 \times 24 = 115200$
$= 1.152 \times 10^5$

(iii) In a year $= 115200 \times 365$
$= 42048000$
$= 4.2048 \times 10^7$

(iv) In 100 years $= 4.2048 \times 10^7 \times 100$
$= 4.2048 \times 10^9$

Challenging Problems

9. A greeting card has an area 90 cm^2. Between what two whole numbers is the length of its side?

Solution :

Area of the greeting card = 90 cm^2

$9^2 = 81$

$10^2 = 100$

$\therefore 81 < 90 < 100$

$\therefore$ Length of its side between 9 cm and 10 cm.

10. 225 square shaped mosaic tiles, each of area 1 square decimetre exactly cover a square shaped verandah. How long is each side of the square shaped verandah?

Solution :

Length of each side of square shaped verandah

$= \sqrt{3^2 \times 5^2}$ $= \sqrt{225}$

$= 3 \times 5 = 15$ decimetre

5	225
5	45
3	9
3	3
	1

11. A group of 1536 cadets wanted to have a parade forming a square design. Is it possible? If it is not possible how many more cadets would be required?

Solution :

The number of cadets $= 1536 = 2^9 \times 3^1$

∴ If is not possible

$39^2 = 1521$

$40^2 = 1600$

Number of more cadets required $= 1600 - 1536 = 64$

2	1536
2	768
2	384
2	192
2	96
2	48
2	24
2	12
2	6
3	3
	1

12. Find the decimal fraction which when multiplied by itself gives 176.252176.

Solution :

The decimal fraction $= \sqrt{176.252176}$

$= \sqrt{\frac{176252176}{1000000}}$

$= \frac{13276}{1000}$

$= 13.276$

(or)

$= \frac{3319}{50}$

	13276
1	1 76 25 21 76
	1
23	76
	69
262	725
	524
2647	20121
	18529
26546	159276
	159276
	0

13. Evaluate: $\sqrt{286225}$ and use it to compute

$\sqrt{2862.25} + \sqrt{28.6225}$

Solution :

$\sqrt{286225} = 535$

$\sqrt{2862.25} + \sqrt{28.6225}$

$\sqrt{\frac{286225}{100}} + \sqrt{\frac{286225}{10000}}$

$= \frac{535}{10} + \frac{535}{100}$

$= 53.5 + 5.35$

$= 58.85$

	535
5	28 62 25
	25
103	362
	309
1065	5325
	5325
	0

14. The speed of light in glass is about 2×10^8 *m*/sec. Use the formula, *time* $= \frac{\textit{distance}}{\textit{speed}}$ to find the time (in hours) for a pulse of light to travel 7200 *km* in glass.

Solution :

$\text{Time} = \frac{\text{distance}}{\text{speed}}$

$= \frac{7200 \text{ km}}{2 \times 10^8 \text{ m/sec}}$

$= \frac{7200 \times 1000 \text{ m}}{2 \times 10^8 \times 3600 \text{ m/hr}}$

$= \frac{10^3}{10^8}$ hours

$= 10^{3-8}$ hours

$= 10^{-5}$ hours

15. Simplify: $(3.769 \times 10^5) + (4.21 \times 10^5)$

Solution :

$(3.769 \times 10^5) + (4.21 \times 10^5)$

$= (3.769 + 4.21) \times 10^5$

$= 7.979 \times 10^5$

---

16. Order the following from the least to the greatest:

$16^{25}, 8^{100}, 3^{500}, 4^{400}, 2^{600}$

Solution :

$16^{25} = (2^4)^{25} = 2^{100}$

$8^{100} = 8^{100}$

$3^{500} = (3^5)^{100} = (243)^{100}$

$4^{400} = (4^4)^{100} = (256)^{100}$

$2^{600} = (2^6)^{100} = (64)^{100}$

$2^{100} < 8^{100} < 64^{100} < 243^{100} < 256^{100}$

$\therefore 16^{25} < 8^{100} < 2^{600} < 3^{500} < 4^{400}$

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Unit- 2. LIFE MATHEMATICS

Exercise 2.1

1. Fill in the blanks :

(i) A can finish a job in 3 days where as B finishes it in 6 days. The time taken to complete the job together is _____days.

Solution :

$$A+B = \frac{1}{3}+\frac{1}{6} = \frac{2+1}{6} = \frac{3}{6} = \frac{1}{2}$$

(ii) If 5 persons can do 5 jobs in 5 days, then 50 persons can do 50 jobs in _____ days.

Solution :

Men	Jobs	Days
5	5	5
50	50	x

$$\text{Days} = \frac{\cancel{5}}{\cancel{50}} \times \frac{\cancel{50}}{\cancel{5}} \times 5$$

$$= 5 \text{ days}$$

(iii) A can do a work in 24 days. A and B together can finish the work in 6 days. Then B alone can finish the work in _____ days.

Solution :

$$B = (A+B) - A$$

$$= \frac{1}{6} - \frac{1}{24} = \frac{4-1}{24} = \frac{3}{24} = \frac{1}{8}$$

8 days

(iv) A alone can do a piece of work in 35 days. If B is 40% more efficient than A, then B will finish the work in _____days.

Solution :

$$B = \frac{1}{35} + \frac{1}{35} \times \frac{\cancel{40}^{2}}{\cancel{100}_{5}}$$

$$= \frac{1}{35} + \frac{2}{175} = \frac{5+2}{175} = \frac{7}{175} = \frac{1}{25}$$

25 days

(v) A alone can do a work in 10 days and B alone in 15 days. They undertook the work for ₹ 200000. The amount that A will get is _____.

Solution :

$$A:B = \frac{1}{10} : \frac{1}{15} = 3:2$$

$$\text{Amount of A} = \frac{3}{\cancel{5}} \times \cancel{200000}^{40000}$$

$$= 1,20,000$$

---

2. 210 men working 12 hours a day can finish a job in 18 days. How many men are required to finish the job in 20 days working 14 hours a day?

Solution :

Men	Hours	Days
210	12	18
x	14	20

$$\text{Hours and Men inverse proportion} = \frac{12}{14}$$

$$\text{Days and Men inverse proportion} = \frac{18}{20}$$

$$\therefore \text{Men required} = \frac{\cancel{12}^{6}}{\cancel{14}_{2}} \times \frac{\cancel{18}^{9}}{\cancel{20}} \times \cancel{210}^{3}$$

$$= 162 \text{ Men}$$

---

3. A cement factory makes 7000 cement bags in 12 days with the help of 36 machines. How many bags can be made in 18 days using 24 machines?

Solution :

Days	Machines	Bags
12	36	7000
18	24	?

$$\text{Days and Bags Direct proportion} = \frac{18}{12}$$

$$\text{Machines and Bags Direct proportion} = \frac{24}{36}$$

Number of bags $= \frac{\cancel{18}}{\cancel{12}} \times \frac{\cancel{24}^{2}}{\cancel{36}_{2}} \times 7000$

$= 7000$ bags

4. A soap factory produces 9600 soaps in 6 days working 15 hours a day. In how many days will it produce 14400 soaps working 3 hours more a day?
Solution:

Soaps	Hours	Days
9600	15	6
14400	18	?

Soaps and days direct variation $= \frac{14400}{9600}$

Hours and days inverse variation $= \frac{15}{18}$

$\text{Days} = \frac{\cancel{14400}^{3}}{\cancel{9600}_{2}} \times \frac{\cancel{15}^{5}}{\cancel{18}_{3}} = \frac{15}{2} = 7\frac{1}{2}$

$= 7\frac{1}{2}$ days

5. If 6 container lorries can transport 135 tonnes of goods in 5 days, how many more lorries are required to transport 180 tonnes of goods in 4 days?
Solution:

Tonnes	Days	Lorries
135	5	6
180	4	?

Tonnes, Lorries direct variation $= \frac{180}{135}$

Days, Lorries inverse variation $= \frac{5}{4}$

Number of Lorries required

$= \frac{\cancel{180}^{45}}{\cancel{3}\ \cancel{135}} \times \frac{5}{\cancel{4}} \times \cancel{6}^{2} = 10$ Lorries

Number of Lorries required more
$= 10 - 6 = 4$ Lorries

6. A can do a piece of work in 12 hours, B and C can do it 3 hours whereas A and C can do it in 6 hours. How long will B alone take to do the same work?
Solution:

A's 1 hour work $= \frac{1}{12}$

(B + C)'s 1 hour work $= \frac{1}{3}$

(A+C)'s 1 hour work $= \frac{1}{6}$

B's 1 hour work = (B + C) - (A+C) + A

$= \frac{1}{3} - \frac{1}{6} + \frac{1}{12} = \frac{4-2+1}{12} = \frac{3}{12} = \frac{1}{4}$

$\therefore$ B takes $= 4$ hours

7. A and B can do a piece of work in 12 days, while B and C can do it in 15 days whereas A and C can do it in 20 days. How long would each take to do the same work?
Solution:

(A+B)'s 1 day's work $= \frac{1}{12}$

(B + C) 's 1 day's work $= \frac{1}{15}$

(A+C)'s 1 day's work $= \frac{1}{20}$

2(A+B+C)'s 1 day's work

$= \frac{1}{12} + \frac{1}{15} + \frac{1}{20} = \frac{5+4+3}{60} = \frac{12}{60} = \frac{1}{5}$

$\therefore$ (A+B+C)'s 1 day's work $= \frac{1}{10}$

A's 1 day's work = (A+B+C) - (B+C)

$= \frac{1}{10} - \frac{1}{15} = \frac{3-2}{30} = \frac{1}{30}$

$\therefore$ A takes $= 30$ days

B's 1 day's work = (A+B+C) - (A+C)

$= \frac{1}{10} - \frac{1}{20} = \frac{2-1}{20} = \frac{1}{20}$

$\therefore$ B takes = 20 days

C's 1 day's work = (A+B+C) - (A+B)

$= \frac{1}{10} - \frac{1}{12} = \frac{6-5}{60} = \frac{1}{60}$

$\therefore$ C takes = 60 days

8. Carpenter A takes 15 minutes to fit the parts of a chair while Carpenter B takes 3 minutes more than A to do the same work. Working together, how long will it take for them to fit the parts for 22 chairs?
Solution :

A's 1 minute work $= \frac{1}{15}$

B's 1 minute work $= \frac{1}{18}$

(A+B)'s 1 minute work $= \frac{1}{15} + \frac{1}{18}$

$\frac{6+5}{90} = \frac{11}{90}$

Time taken by (A+B) for 1 chair

$= \frac{90}{11}$ minutes

Time taken by (A+B) for 22 chairs

$= \frac{90}{\cancel{11}} \times \cancel{22}^{2} = 180$ minutes

= 3 hours

9. A man takes 10 days to finish a job where as a woman takes 6 days to finish the same job. Together they worked for 3 days and then the woman left . In how many days will the man complete the remaining job?
Solution :

Man's one day work $= \frac{1}{10}$

Woman's one day work $= \frac{1}{6}$

Work finished by them in 3 days

$= 3\left(\frac{1}{10} + \frac{1}{6}\right) = 3\left(\frac{3+5}{30}\right) = \cancel{3}^{1}\left(\frac{8}{\cancel{30}_{10}}\right) = \frac{8}{10}$

Remaining work $= 1 - \frac{8}{10} = \frac{2}{10}$

$\therefore$ Days taken by a man to complete the remaining work

$= \frac{\frac{2}{10}}{\frac{1}{10}} = \frac{2}{\cancel{10}} \times \frac{\cancel{10}}{1} = 2$ days

10. A is thrice as fast as B. If B can do a piece of work in 24 days, then find the number of days they will take to complete the work together
Solution :

A:B = 1:3

$\frac{1}{3} = \frac{x}{24}$

$3x = 24$

$x = 8$

A takes = 8 days

(A+B)'s 1 day's work $= \frac{1}{8} + \frac{1}{24}$

$= \frac{3+1}{24} = \frac{4}{24} = \frac{1}{6}$

Days taken by them = 6 days

Try these

Classify the given examples as direct or inverse proportion:
(i) Weight of pulses to their cost.
Solution : Direct proportion

(ii) Distance travelled by bus to the price of ticket.
Solution : Direct proportion

(iii) Speed of the athelete to cover a certain distance.
Solution : Inverse proportion

(iv) Number of workers employed to complete a construction in a specified time.
Solution : Inverse proportion

(v) Volume of water flown through a pipe to its pressure.
Solution : Direct proportion

(vi) Area of a circle to its radius.
Solution : Direct proportion

Try these

1. When $x = 5$ and $y = 5$ find k, if x and y vary directly.
Solution :

$y = kx$
$\Rightarrow 5 = 5k$
$\Rightarrow k = 1$

2. When x and y vary inversely, find the constant of variation when $x = 64$ and $y = 0.75$
Solution :

$xy = k$
$\Rightarrow k = (64)(0.75) = 48$

3. You draw a circle of a given radius. Then, draw its radii in such a way that the angles between any pair of radii are equal. You start with drawing 3 radii and end with drawing 12 radii in the circle. Prepare a table for the number of radii to the angle between a pair of consecutive radii and check whether they are in inverse proportion. What is the proportionality constant?
Solution :

Radii	Angle
3	120°
6	60°
12	30°
24	15°

∴ Inverse proportion

$xy = k$
$\Rightarrow k = (3)(120) = 360$

Think

(i) When x and y are in direct proportion and if y is doubled, then what happens to x?
Solution :

$y = kx$
$\Rightarrow (2y) = k(2x)$
∴ x also doubled

(ii) If $\frac{x}{y-x} = \frac{6}{7}$ What is $\frac{x}{y}$?
Solution :

$$\frac{x}{y-x} = \frac{6}{7} = \frac{x}{y-x+x}$$
$$= \frac{6}{6+7} \Rightarrow \frac{x}{y} = \frac{6}{13}$$

Try these

Identify the different variations present in the following questions:
1. 24 men can make 48 articles in 12 days. Then, 6 men can make _____articles in 6 days.
Solution :

Men	Days	Articles
24	12	48
6	6	?

Number of Articles

$$= \frac{\cancel{6}^{3}}{\cancel{24}} \times \frac{\cancel{6}}{\cancel{12}} \times \cancel{48}^{2} = 6 \text{ articles}$$
$$\cancel{2}$$

2. 15 workers can lay a road of length 4 km in 4 hours. Then, _____ workers can lay a road of length 8 km in 8 hours.
Solution :

Hours	Length	Workers
4	4	15
8	8	?

Number of workers

$$= \frac{\cancel{4}}{\cancel{8}} \times \frac{\cancel{8}}{\cancel{4}} \times 15 = 15 \text{ workers}$$

3. 25 women working 12 hours a day can complete a work in 36 days. Then, 20 women must work _____ hours a day to complete the same work in 30 days.

Solution :

Women	Days	Hours
25	36	12
20	30	?

Number of Hours

$= \frac{\cancel{25}^{5}}{\cancel{20}_{4}} \times \frac{\cancel{36}^{6}}{\cancel{30}_{5}} \times \cancel{12}^{3} = 18$ hours

---

4. In a camp, there are 420 kg of rice sufficient for 98 persons for 45 days. The number of days that 60 kg of rice will last for 42 persons is _____.

Solution :

Persons	Kg	Days
98	420	45
42	60	?

Number of Days

$= \frac{\cancel{98}^{14}}{\cancel{42}_{3}} \times \frac{\cancel{60}^{1}}{\cancel{420}_{7}} \times \cancel{45}^{15} = 15$ days

---

Try these

1. Vikram can do one-third of work in *p* days. He can do $\frac{3}{4}$ th of work in _____ days.

Solution :

Work	Days
$\frac{1}{3}$	p
$\frac{3}{4}$	?

Number of days $= \frac{\frac{3}{4}}{\frac{1}{3}} \times p$

$= \frac{3}{4} \times \frac{3}{1} \times p = \frac{9}{4} p$

---

2. If *m* persons can complete a work in *n* days ,then *4m* persons can complete the same work in _____days and $\frac{m}{4}$ persons can complete the same work in _____ days.

Solution :

Persons	Days
m	n
4m	?
$\frac{m}{4}$	?

Days taken by 4m persons

$= \frac{\cancel{m}}{\cancel{4m}} \times n = \frac{n}{4}$ days

Days taken by $\frac{m}{4}$ persons

$= \frac{m}{\frac{m}{4}} \times n = \cancel{m} \times \frac{4}{\cancel{m}} \times n = 4n$ days

---

Exercise 2.2
Miscellaneous and Practice Problems

1. 5 boys or 3 girls can do a science project in 40 days. How long will it take for 15 boys and 6 girls to do the same project?

Solution :

Boys	Days
5	40
25	?

5 Boys = 3 Girls

∴ 10 Boys = 6 Girls

∴ 15 Boys + 6 Girls

= (15 + 10) Boys = 25 Boys

Number of days required $= \frac{\cancel{5}}{\cancel{25}_{5}} \times \cancel{40}^{8} = 8$ days

2. If 32 men working 12 hours a day can do a work in 15 days, how many men working 10 hours a day can do double that work in 24 days?

Solution :

Work	Hours	Days	Men
1	12	15	32
2	10	24	?

Work and Men direct proportion $= \frac{2}{1}$

Hours and Men inverse proportion $= \frac{12}{10}$

Days and Men inverse proportion $= \frac{15}{24}$

Number of Men needed

$$= \frac{\cancel{2}}{1} \times \frac{\cancel{12}}{\cancel{2}\cancel{10}} \times \frac{\cancel{15}^{3}}{\cancel{24}\cancel{2}} \times \cancel{32}^{16}$$

$= 48$ Men

---

3. Amutha can weave a saree in 18 days. Anjali is twice as good a weaver as Amutha. If both of them weave together, in how many days can they complete weaving the saree?

Solution :

Number of days taken by Amutha $= 18$ days

Number of days taken by Anjali

$$= \frac{18}{2} = 9 \text{ days}$$

Work finished by Amutha and Anjali in 1 day

$$= \frac{1}{18} + \frac{1}{9} = \frac{2+1}{18} = \frac{3}{18} = \frac{1}{6}$$

∴ Number of days taken by them $= 6$ days

---

4. A, B and C can complete a work in 5 days. If A and C can complete the same work in $7\frac{1}{2}$ days and A alone in 15 days, then in how many days can B and C finish the work?

Solution :

Work finished by (A+B+C) in 1 day $= \frac{1}{5}$

Work finished by (A) in 1 day $= \frac{1}{15}$

Work finished by (B+C) in 1 day

$$= \frac{1}{5} - \frac{1}{15} = \frac{3-1}{15} = \frac{2}{15}$$

∴ Days taken by (B and C)

$$= \frac{15}{2} \text{ days} = 7\frac{1}{2} \text{ days}$$

---

5. P and Q can do a piece of work in 12 days and 15 days respectively. P started the work alone and then, after 3 days Q joined him till the work was completed. How long did the work last?

Solution :

P's 1 day's work $= \frac{1}{12}$

Q's 1 day's work $= \frac{1}{15}$

(P+Q)'s 1 day's work $= \frac{1}{12} + \frac{1}{15}$

$$= \frac{5+4}{60} = \frac{9}{60} = \frac{3}{20}$$

Work finished by 'P' in 3 days $= 3 \times \frac{1}{12} = \frac{1}{4}$

Remaining work $= 1 - \frac{1}{4} = \frac{3}{4}$

∴ Days taken by 'P & Q' to complete the remaining work

$$= \frac{\frac{3}{4}}{\frac{3}{20}} = \frac{\cancel{3}}{\cancel{4}} \times \frac{\overset{5}{\cancel{20}}}{\cancel{3}} = 5 \text{ days}$$

∴ Total number of days = 3 + 5 = 8 days

Challenging Problems

6. A camp had provisions for 490 soldiers for 65 days. After 15 days, more soldiers arrived and the remaining provisions lasted for 35 days. How many soldiers joined the camp?

Solution :

Days	Quantity	Soldiers
65	1	490
35	$\frac{50}{65}$	?

(65 - 15=50)

Days, Soldiers inverse proportion $= \frac{65}{35}$

Quantity, Soldiers direct proportion $= \frac{50}{65}$

Number of Soldiers

$$= \frac{\cancel{65}}{\cancel{7}\ \cancel{35}} \times \frac{\cancel{50}^{10}}{\cancel{65}} \times \overset{70}{\cancel{490}} = 700 \text{ Soldiers}$$

Number of Soldiers joined

= 700 - 490 = 210 Soldiers

7. A small–scale company undertakes an agreement to make 540 motor pumps in 150 days and employs 40 men for the work. After 75 days, the company could make only 180 motor pumps. How many more men should the company employ so that the work is completed on time as per the agreement?

Solution :

Pumps	Days	Work	Men
540	150	1	40
360	75	$\frac{1}{2}$	?

Number of Men needed

$$= \frac{\overset{3}{\cancel{540}}}{\cancel{2}\ \cancel{360}} \times \frac{\overset{2}{\cancel{150}}}{\cancel{75}} \times \frac{1}{\cancel{2}} \times \frac{20}{\cancel{40}} = 60 \text{ Men}$$

Number of Men needed more

= 60 - 40 = 20 Men

8. A can do a work in 45 days. He works at it for 15 days and then, B alone finishes the remaining work in 24 days. Find the time taken to complete 80% of the work, if they work together.

Solution :

A's 1 day's work $= \frac{1}{45}$

A's 15 day's work $= 15 \times \frac{1}{45} = \frac{1}{3}$

Remaining work $= 1 - \frac{1}{3} = \frac{2}{3}$

B's 1 day's work $= \frac{\frac{2}{3}}{24} = \frac{\cancel{2}}{3} \times \frac{1}{\cancel{24}\ 12} = \frac{1}{36}$

(A+B)'s 1 day's work $= \frac{1}{45} + \frac{1}{36}$

$$= \frac{4+5}{180} = \frac{9}{180} = \frac{1}{20}$$

∴ A and B takes = 20 days

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Work	Days
1	20
$\frac{80}{100}$	?

Number of days = $\frac{80}{100} \times 20 = 16$

∴ 16 days

9. P alone can do $\frac{1}{2}$ of a work in 6 days and Q alone can do $\frac{2}{3}$ of the same work in 4 days. In how many days working together, will they finish $\frac{3}{4}$ of the work?

Solution :

Number of days taken by 'P' = 6 x 2 = 12 days

Number of days taken by 'Q' = $\frac{2}{4} \times \frac{3}{2}$ = 6 days

(P+Q)' 1 day work = $\frac{1}{12} + \frac{1}{6}$

$= \frac{1+2}{12} = \frac{3}{12} = \frac{1}{4}$

∴ Days to complete $\frac{3}{4}$ of work

$= \frac{\frac{3}{4}}{\frac{1}{4}} = \frac{3}{4} \times \frac{4}{1} = 3$ days

10. X alone can do a piece of work in 6 days and Y alone in 8 days. X and Y undertook the work for ₹4800. With the help of Z, they completed the work in 3 days. How much is Z's share?

Solution :

X's 1 day work = $\frac{1}{6}$

Y's 1 day work = $\frac{1}{8}$

(X+Y+Z)'s 1 day work = $\frac{1}{3}$

Z's 1 day work = $\frac{1}{3} - \frac{1}{6} - \frac{1}{8}$

$= \frac{8-4-3}{24} = \frac{1}{24}$

X:Y:Z = $\frac{1}{6} : \frac{1}{8} : \frac{1}{24}$

$= \frac{1}{6} \times 24 : \frac{1}{8} \times 24 : \frac{1}{24} \times 24$

= 4:3:1

Z's share = $\frac{1}{8} \times 4800 = ₹600$