

## Exercise 1.6

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1. Without actually performing the long division, state whether the following rational numbers will have a terminating decimal expansion or a non-terminating repeating decimal expansion.

(i)  $23/8$

**Solution:**

We have,  $23/8$  and here the denominator is 8.

$$\Rightarrow 8 = 2^3 \times 5$$

We see that the denominator 8 of  $23/8$  is of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

Hence,  $23/8$  has terminating decimal expansion. And, the decimal expansion of  $23/8$  terminates after three places of decimal.

(ii)  $125/441$

**Solution:**

We have,  $125/441$  and here the denominator is 441.

$$\Rightarrow 441 = 3^2 \times 7^2$$

We see that the denominator 441 of  $125/441$  is not of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

Hence,  $125/441$  has non-terminating repeating decimal expansion.

(iii)  $35/50$

**Solution:**

We have,  $35/50$  and here the denominator is 50.

$$\Rightarrow 50 = 2 \times 5^2$$

We see that the denominator 50 of  $35/50$  is of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

Hence,  $35/50$  has terminating decimal expansion. And, the decimal expansion of  $35/50$  terminates after two places of decimal.

(iv)  $77/210$

**Solution:**

We have,  $77/210$  and here the denominator is 210.

$$\Rightarrow 210 = 2 \times 3 \times 5 \times 7$$

We see that the denominator 210 of  $77/210$  is not of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

Hence,  $77/210$  has non-terminating repeating decimal expansion.

(v)  $129/(2^2 \times 5^7 \times 7^{17})$

**Solution:**

We have,  $129/(2^2 \times 5^7 \times 7^{17})$  and here the denominator is  $2^2 \times 5^7 \times 7^{17}$ .

Clearly,

We see that the denominator is not of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

And hence,  $129/441$  has non-terminating repeating decimal expansion.

(vi)  $987/10500$

**Solution:**

We have,  $987/10500$

But,  $987/10500 = 47/500$  (reduced form)

And now the denominator is 500.

$$\Rightarrow 500 = 2^2 \times 5^3$$

We see that the denominator 500 of  $47/500$  is of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

Hence,  $987/10500$  has terminating decimal expansion. And, the decimal expansion of  $987/10500$  terminates after three places of decimal.

**2. Write down the decimal expansions of the following rational numbers by writing their denominators in the form of  $2^m \times 5^n$ , where  $m$ , and  $n$ , are the non-negative integers.**

(i)  $3/8$

**Solution:**

The given rational number is  $3/8$

It's seen that,  $8 = 2^3$  is of the form  $2^m \times 5^n$ , where  $m = 3$  and  $n = 0$ .

So, the given number has terminating decimal expansion.

$$\therefore \frac{3 \times 5^3}{2^3 \times 5^3} = \frac{3 \times 125}{(2 \times 5)^3} = \frac{375}{(10)^3} = \frac{375}{1000} = 0.375$$

(ii)  $13/125$

**Solution:**

The given rational number is  $13/125$ .

It's seen that,  $125 = 5^3$  is of the form  $2^m \times 5^n$ , where  $m = 0$  and  $n = 3$ .

So, the given number has terminating decimal expansion.

$$\therefore 13/125 = (13 \times 2^3)/(125 \times 2^3) = 104/1000 = 0.104$$

(iv)  $7/80$

**Solution:**

The given rational number is  $7/80$ .

It's seen that,  $80 = 2^4 \times 5$  is of the form  $2^m \times 5^n$ , where  $m = 4$  and  $n = 1$ .

So, the given number has terminating decimal expansion.

$$\therefore \frac{7}{80} = \frac{7 \times 5^3}{2^4 \times 5 \times 5^3} = \frac{7 \times 125}{(2 \times 5)^4} = \frac{875}{10^4} = \frac{875}{10000} = 0.0875$$

(v)  $14588/625$

**Solution:**

The given rational number is  $14588/625$ .

It's seen that,  $625 = 5^4$  is of the form  $2^m \times 5^n$ , where  $m = 0$  and  $n = 4$ .

So, the given number has terminating decimal expansion.

$$\therefore \frac{14588}{625} = \frac{14588 \times 2^4}{2^4 \times 5^4} = \frac{233408}{10^4} = \frac{233408}{10000} = 23.3408$$

(vi)  $129/(2^2 \times 5^7)$

**Solution:**

The given number is  $129/(2^2 \times 5^7)$ .

It's seen that,  $2^2 \times 5^7$  is of the form  $2^m \times 5^n$ , where  $m = 2$  and  $n = 7$ .

So, the given number has terminating decimal expansion.

$$\therefore \frac{129}{2^2 \times 5^7} = \frac{129 \times 2^5}{2^2 \times 5^7 \times 2^5} = \frac{129 \times 32}{(2 \times 5)^7} = \frac{4128}{10^7} = \frac{4128}{10000000} = 0.0004128$$

**3. Write the denominator of the rational number  $257/5000$  in the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers. Hence, write the decimal expansion, without actual division.**

**Solution:**

The denominator of the given rational number is 5000.

$$\Rightarrow 5000 = 2^3 \times 5^4$$

It's seen that,  $2^3 \times 5^4$  is of the form  $2^m \times 5^n$ , where  $m = 3$  and  $n = 4$ .

$$\therefore 257/5000 = (257 \times 2)/(5000 \times 2) = 514/10000 = 0.0514 \text{ is its decimal expansion.}$$

**4. What can you say about the prime factorization of the denominators of the following rational:**

**(i) 43.123456789**

**Solution:**

Since 43.123456789 has terminating decimal expansion. Hence, its denominator is of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

**(ii)  $43.\overline{123456789}$**

**Solution:**

Since the given rational has non-terminating decimal expansion. So, its denominator has factors other than 2 or 5.

**(iii)  $27.\overline{142857}$**

**Solution:**

Since the given rational number has non-terminating decimal expansion. So, its denominator has factors other than 2 or 5.

**(iv) 0.120120012000120000....**

**Solution:**

Since 0.120120012000120000.... has non-terminating decimal expansion. So, its denominator has factors other than 2 or 5.

**5. A rational number in its decimal expansion is 327.7081. What can you say about the prime factors of  $q$ , when this number is expressed in the form  $p/q$ ? Give reasons.**

**Solution:**

Since, 327.7081 has a terminating decimal expansion its denominator should be of the form  $2^m \times 5^n$ , where  $m, n$  are non-negative integers.

Further,

327.7081 can be expressed as  $3277081/10000 = p/q$

$$\Rightarrow q = 1000 = 2^3 \times 5^3$$

Hence, the prime factors of  $q$  has only factors of 2 and 5.