CHAPTER-2

EXPONENTS

QUESTION BANK

1. $[(-3)^2]^3$ is equal to
   (a) $(-3)^8$ (b) $(-3)^6$
   (c) $(-3)^5$ (d) $(-3)^{23}$
2. For a non-zero rational number x, $x^8 \div x^2$ is equal to
   (a) x^4 (b) x^6 (c) x^{10} (d) x^{16}
3. x is a non-zero rational number. Product of the square of x with the cube of x is equal to the
   (a) second power of x (b) third power of x
   (c) fifth power of x (d) sixth power of x
4. For any two non-zero rational numbers x and y, $x^5 \div y^5$ is equal to
   a) $(x \div y)^1$ (b) $(x \div y)^0$
   (c) $(x \div y)^5$ (d) $(x \div y)^{10}$
5. $a^m \times a^n$ is equal to
   (a) $(a^2)^{mn}$ (b) a^{m-n}
   (c) a^{m+n} (d) a^{mn}
6. $(1° + 2° + 3°)$ is equal to
   (a) 0 (b) 1 (c) 3 (d) 6
7. The standard form of the number 12345 is
   (a) 1234.5×10^1 (b) 123.45×10^2
   (c) 12.345×10^3 (d) 1.2345×10^4
8. Which of the following is equal to 1?
   (a) $2° + 3° + 4°$ (b) $2° \times 3° \times 4°$
   (c) $(3° - 2°) \times 4°$ (d) $(3° - 2°) \times (3° + 2°)$
9. In standard form, the number 72105.4 is written as 7.21054×10^n, where n is equal to
   (a) 2 (b) 3 (c) 4 (d) 5
10. Which power of 8 is equal to 2^6?
    (a) 3 (b) 2 (c) 1 (d) 4
11. Which of the following is not true?
    (a) $3^2 > 2^3$ (b) $4^3 = 2^6$ (c) $3^3 = 9$ (d) $2^5 > 5^2$
12. In standard form 72 crore is written as
    (a) 72×10^7 (b) 72×10^8 (c) 7.2×10^8 (d) 7.2×10^7
13. **For a fixed base, if the exponent decreases by 1, the number becomes**
    (a) one-tenth of the previous number
    (b) ten times of the previous number
    (c) hundredth of the previous number
    (d) hundred times of the previous number
14. **The value of $3^5 \div 3^{-6}$ is**

(a) 3^5 (b) 3^{-6} (c) 3^{11} (d) 3^{-11}

15. The multiplicative inverse of 10^{-100} is

(a) 10 (b) 100 (c) 10^{100} (d)10^{-100}

16. The value of $(-2)^{2 \times 3-1}$ is

(a) 32 (b) 64 (c) -32 (d) -64

17. If y be any non-zero integer, then y^0 is equal to

(a) 1 (b) 0 (c) – 1 (d) not defined

18. If x be any non-zero integer, then x^{-1} is equal to

(a) x (b) 1/x (c) – x (d) -1/x

19. The standard form for 0.000064 is

(a) 64×10^4 (b) 64×10^{-4} (c) 6.4×10^5 (d) 6.4×10^{-5}

20. The standard form for 234000000 is

(a) 2.34×10^8 (b) 0.234×10^9

(c) 2.34×10^{-8} (d) 0.234×10^{-9}

21. The usual form for 2.03×10^{-5} is

(a) 0.203 (b) 0.00203 (c) 203000 (d) 0.0000203

Fill in the Blanks:

22. The multiplicative inverse of 10^{10} is_____

23. $a^3 \times a^{-10}$ = _____

24. 5^0 = _____

25. $5^5 \times 5^{-5}$= _____

26. The expression for 8^{-2} as a power with the base 2 is_____

27. Very small numbers can be expressed in standard form by using_____ exponents

28. Very large numbers can be expressed in standard form by using ---------- exponents.

29. By multiplying $(10)^5$ by $(10)^{-10}$, we get --------.

30. The value of 3×10^{-7} is equal to_____

31. To add the numbers given in standard form, we first convert them into number with_____exponents.

32. The standard form for 32500000000 is_____.

33. The standard form for 0.000000008 is_____.

34. The usual form for 2.3×10^{-10} is_____.

35. On dividing 8^5 by_____. we get 8.

36. The value of 3×10^{-7} is equal to_____

37. To add the numbers given in standard form, we first convert them into number with_____exponents.

38. Solve the following,

(i) 100^{-10}

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

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

39. Express $3^{-5} \times 3^{-4}$ as a power of 3 with positive exponent.

40. Express 16^{-2} as a power with the base 2.

41. Find the product of the cube of (-2) and the square of (+4).

42. Simplify

(i) $\left(\frac{1}{4}\right)^{-2}+\left(\frac{1}{2}\right)^{-2}+\left(\frac{1}{3}\right)^{-2}$ (ii) $\left(\left(\frac{-2}{3}\right)^{-2}\right)^{3}\times\left(\frac{1}{3}\right)^{-4}\times 3^{-1}\times\frac{1}{6}$

(iii) $\frac{49\times z^{-3}}{7^{-3}\times 10\times z^{-5}}\ (z\neq 0)$ (iv) $(2^{5}\div 2^{8})\times 2^{-7}$

43. Find the value of x, so that

(i) $\left(\frac{5}{3}\right)^{-2}\times\left(\frac{5}{3}\right)^{-14}=\left(\frac{5}{3}\right)^{8x}$ (ii) $(-2)^{3}\times(-2)^{-6}=(-2)^{2x-1}$

(iii) $(2^{-1}+4^{-1}+6^{-1}+8^{-1})^{x}=1$

44. Divide 293 by 1000000 and express the result in standard form.

45. By what number should we multiply (-29)°, so that the product becomes (+29)°.

46. By what number should $(-15)^{-1}$ be divided so that quotient may be equal to $(-15)^{-1}$?

47. Find the multiplicative inverse of $(-7)^{2}\div(90)^{-1}$

48. Write 390000000 in the standard form.

49. Write 0.000005678 in the standard form.

50. Express the product of 3.2×10^{6} and 4.1×10^{1} in the standard form.

51. Some migratory birds travel as much as 15000 km to escape the extreme climatic conditions at home. Write the distance in metres using scientific notation.

52. Pluto is 5913000000 m from the Sun. Express this in the standard form.

53. Special balances can weigh something as 0.00000001 gram. Express this number in the standard form.

54. A sugar factory has annual sales of 3 billion 720 million kilograms of sugar. Express this number in the standard form.

55. The number of red blood cells per cubic millimetre of blood is approximately mm^{3}

56. **Express each of the following in standard form:**

(a) The mass of a proton in gram is $\frac{1673}{1000000000000000000000000000}$

(b) A helium atom has a diameter of 0.000000022 cm.

(c) Mass of a molecule of hydrogen gas is about 0.000000000000000000000334 tonnes.

(d) Human body has 1 trillon of cells which vary in shapes and sizes.

(e) Express 56 km in m.

(f) Express 5 tonnes in g.

(g) Express 2 yr in seconds.

(h) Express 5 hectares in cm^{2}. (1 hec = 10000 m^{2})

57. Evaluate: $\frac{125\times x^{-3}}{5^{-3}\times 25\times x^{-6}}$

58. Find x, so that $\left(\frac{2}{9}\right)^3 \times \left(\frac{2}{9}\right)^{-6} = \left(\frac{2}{9}\right)^{2x-1}$.

59. By what number should $\left(\frac{-3}{2}\right)^{-3}$ be divided so that the quotient may be $\left(\frac{4}{27}\right)^{-2}$?

60. **find the value of n.**

$$\frac{6^n}{6^{-2}} = 6^3$$

61. $$\frac{2^n \times 2^6}{2^{-3}} = 2^{18}$$

62. If $\frac{5^m \times 5^3 \times 5^{-2}}{5^{-5}} = 5^{12}$, then find m.

63. **A new born bear weights 4 kg. How many kilograms might a five year old bear weight if its weight increases by the power of 2 in 5 yr?**

64. **The cell of a bacteria doubles in every 30 min. A scientist begins with a single cell. How many cells will be thereafter (a) 12 h (b) 24 h ?**

65. Planet A is at a distance of 9.35 x 10^6 km from Earth and planet B is 6.27 x 107 km from Earth. Which planet is nearer to Earth?

66. The cells of bacteria double itself every hour. How many cells will be there after 8 h, if initially we start with 1 cell. Express the answer in powers.

67. The planet Uranus is approximately 2,896,819,200,000 metres away from the Sun. What is this distance in standard form?

68. An inch is approximately equal to 0.02543 metres. Write this distance in standard form.

69. The volume of the Earth is approximately 7.67 x 10^{-7} times the volume of the Sun. Express this figure in usual form.

70. An electron's mass is approximately 9.1093826 x 10^{-31} kilograms. What is its mass in grams?

71. At the end of the 20th century, the world population was approximately 6.1 x 10^9 people. Express this population in usual form. How would you say this number in words?

72. About 230 billion litres of water flows through a river each day, how many litres of water flows through that river in a week? How many litres of water flows through the river in an year? Write your answer in standard notation.

73. A half-life is the amount of time that it takes for a radioactive substance to decay one-half of its original quantity.

Suppose radioactive decay causes 300 grams of a substance to decrease 300 x 2^{-3} grams after 3 half-lives. Evaluate 300 x 2^{-3} to determine how many grams of the substance is left.
Explain why the expression 300 x 2^{-n} can be used to find the amount of the substance that remains after n half-lives.

74. Consider a quantity of a radioactive substance. The fraction of this quantity that remains after t half-lives can be found by using the expression 3^{-t}.
(a) What fraction of the substance remains after 7 half-lives?
(b) After how many half-lives will the fraction be 1/243 of the original?

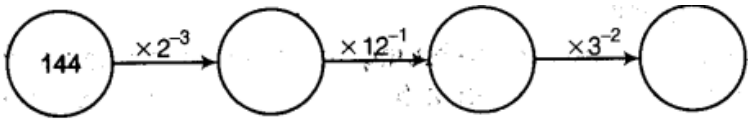
75. **One fermi is equal to 10^{-15} metre. The radius of a proton is 1.3 fermi. Write the radius of a proton (in metres) in standard form.**

76. **Use the properties of exponents to verify that each statement is true.**

(a) $\frac{1}{4}(2^n) = 2^{n-2}$ (b) $4^{n-1} = \frac{1}{4}(4)^n$

(c) $25(5^{n-2}) = 5^n$

76. **Fill in the blanks.**



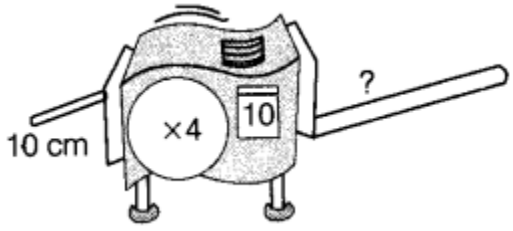
77. **There are 86400 sec in a day. How many days long is a second? Express your answer in scientific notation.**

78. The given table shows the crop production of a state in the year 2008 and 2009. Observe the table given below and answer the given questions.

Crop	2008 Harvest (Hectare)	Increase/Decrease (Hectare) in 2009
Bajra	1.4×10^3	−100
Jowar	1.7×10^6	−440000
Rice	3.7×10^3	−100
Wheat	5.1×10^5	+ 190000

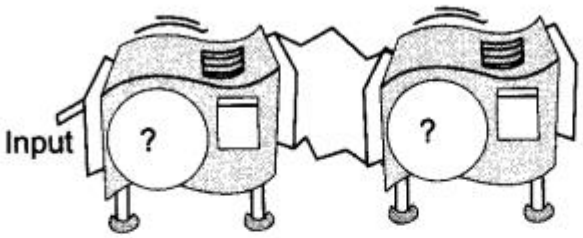
(a) For which crop(s) did the production decrease?
(b) Write the production of all the crops in 2009 in their standard form.
(c) Assuming the same decrease in rice production each year as in 2009, how many acres will be harvested in 2015? Write in standard form.

79. Suppose you have a stretching machine which could stretch almost anything, e.g. If you put a 5 m stick into a (x 4) stretching machine (as shown below), you get a 20 m stick.
Now, if you put 10 cm carrot into a (x 4) machine, how long will it be when it comes out?

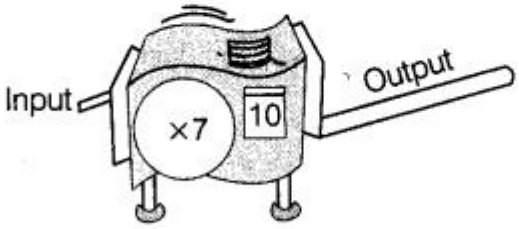


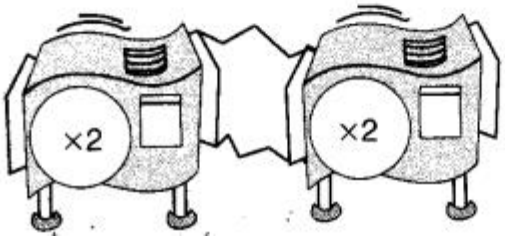
80. **Two machines can be hooked together. When something is sent through this hook up, the output from the first machine becomes the input for the second.**

(a) Which two machines hooked together do the same work a $(\times 10^2)$ machine does? Is there more than one arrangement of two machines that will work?

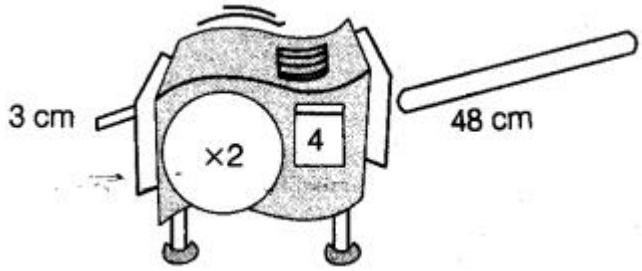


(b) Which stretching machine does the same work as two $(\times 2)$ machines hooked together?



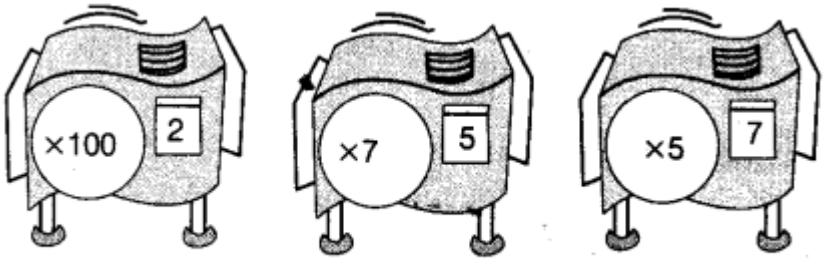


81. Similarly, repeater machine is a hypothetical machine which automatically enlarges items several times, e.g. Sending a piece of wire through a (x 2^4) machine is the same as putting it through a (x 2) machine four times. '
So, if you send a 3 cm piece of wire thorugh a (x 2)4 machine, its length becomes 3 x 2 x 2 x 2 x 2 = 48 cm. It can also be written that a base (2) machine is being applied 4 times.



What will be the new length of a 4 cm strip inserted in the machine?

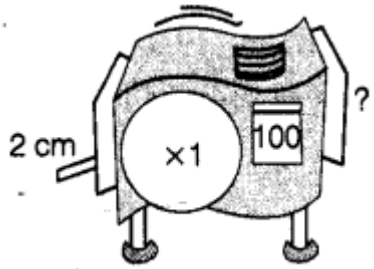
82. **For the following repeater machines, how many times the base machine is applied and how much the total stretch is?**



(a) (b) (c)

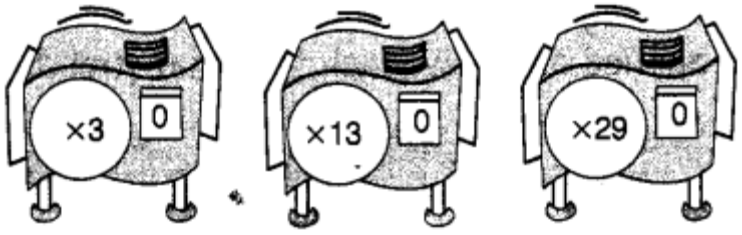
83. Find three repeater machines that will do the same work as a (x 64) machine. Draw them, or describe them using exponents.'

84. What will the following machine do to a 2 cm long piece of chalk?



85. In a repeater machine with 0 as an exponent, the base machine is applied 0 times.

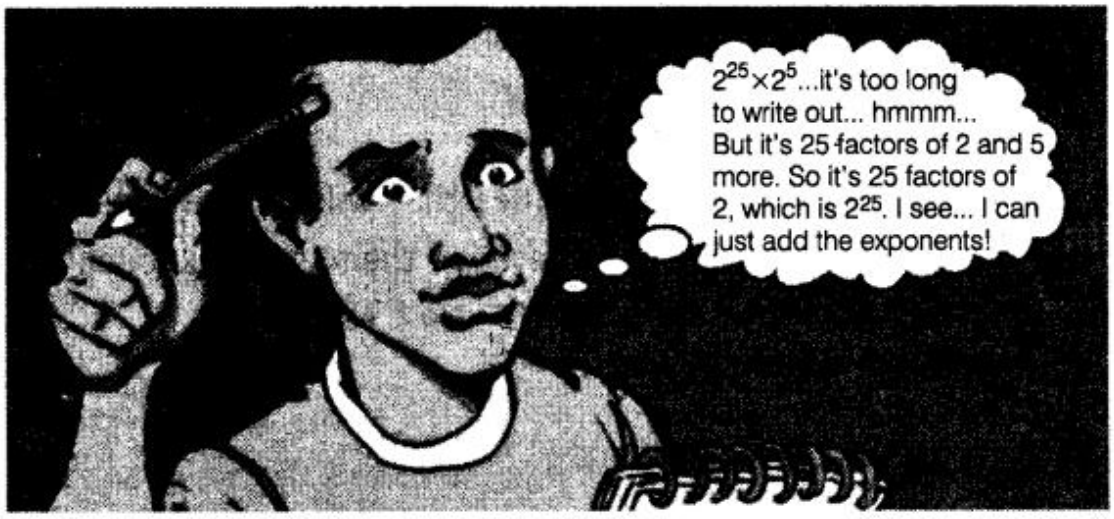
(a) What do these machines do to a piece of chalk?



(b) What do you think the value of 6° is?

You have seen that a hookup of repeater machines with the same base can be replaced by a single repeater machine. Similarly, when you multiply exponential expressions with the same base, you can replace them with a single expression.

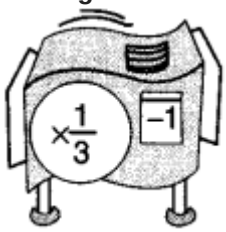
Asif Raza thought about how he could rewrite the expression 220 x 2^5.



Asif Raza's idea is one of the product laws of exponents, which can be expressed like this

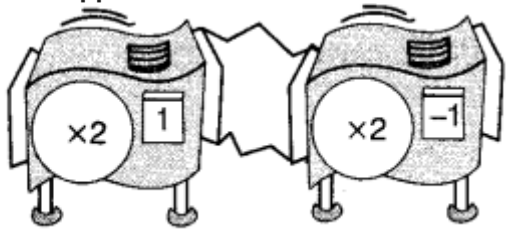
Multiplying Expressions with the Same Base ab x ac = ab+ c

86. Shrinking Machine In a shrinking machine, a piece of stick is compressed to reduce its length. If 9 cm long sandwich is put into the shrinking machine below, how long will it be when it emerges?

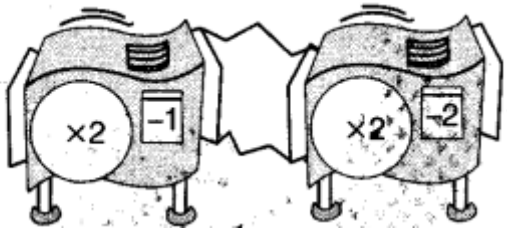


87. What happens when 1 cm worms are sent through these hook-ups?

(i)

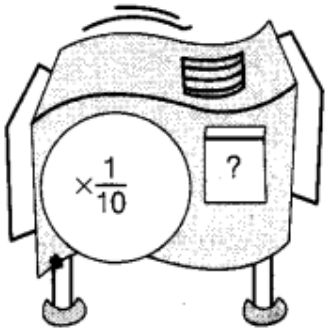


(ii)



88. Sanchay put a 1 cm stick of gum through a (1 x 3^{-2}) machine. How long was the stick when it came out?

89. Ajay had a 1 cm piece of gum. He put it through repeater machine given below and it came out 1/100000 cm long. What is the missing value?



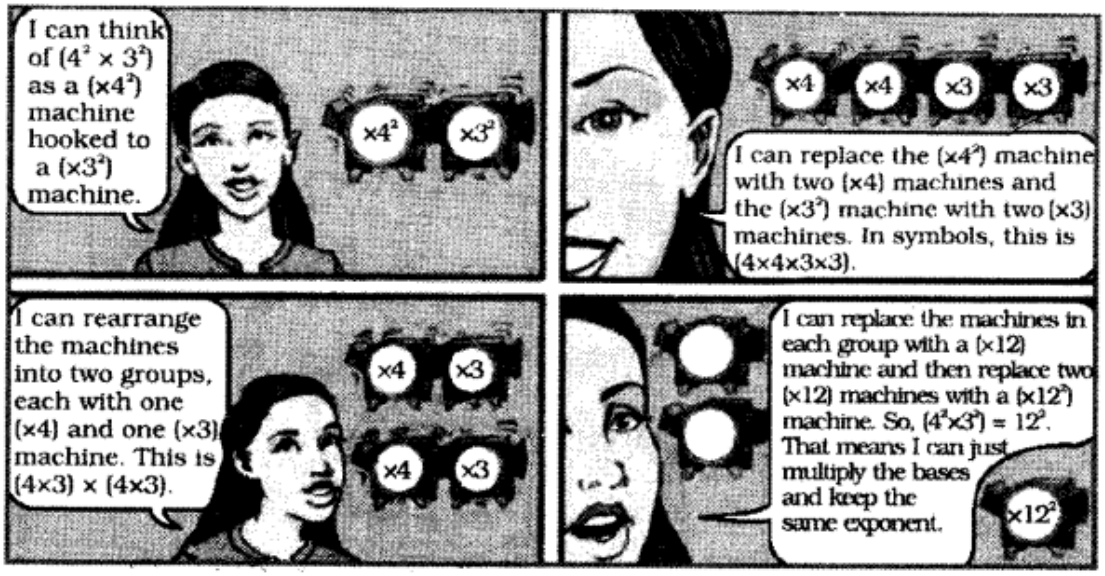
89. Find a single machine that will do the same job as the given hook-up.

(a) a$(\times 2^3)$ machine followed by $(\times 2^{-2})$ machine.

(b) a $(\times 2^4)$ machine followed by $\left(\times\left(\frac{1}{2}\right)^2\right)$ machine.

(c) a $(\times 5^{99})$ machine followed by a (5^{-100}) machine.

Maya multiplied $(4^2 \times 3^2)$ by thinking about stretching machines.



Use Maya's idea to multiply $5^3 \times 2^3$.

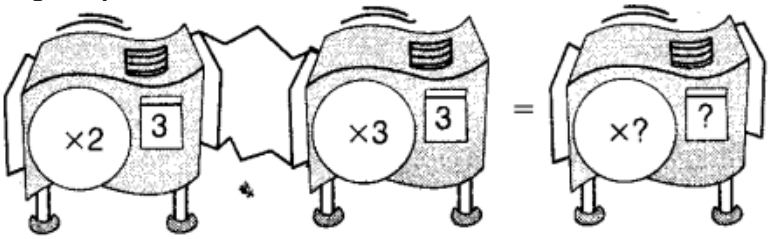
Maya's idea is another product law of exponents.

Multiplying Expressions with the Same Exponents

$$a^c \times b^c = (a \times b)^c$$

You can use this law with more than two expressions. If the exponents are the same, multiply the expressions by multiplying the bases and using the same exponent. e.g. $2^8 \times 3^8 \times 7^8 = (2 \times 3 \times 7)^8 = 42^8$.

90. Shikha has an order from a golf course designer to put palm trees through a (x 2^3) machine and then through a (x 3^3) machine. She thinks that she can do the job with a single repeater machine. What single repeater machine she should use?



91. **The diameter of the Sun is 1.4 x 10^9 m and the diameter of the Earth is 1.2756 x 10^7 m. Compare their diameters by division.**

92. Mass of Mars is 6.42 x 10^{29} kg and mass of the Sun is 1.99 x 10^{30} kg. What is the total mass?

93. The distance between the Sun and the Earth is 1.496 x 10^8 km and : distance between the Earth and the Moon is 3.84 x 10^8 m. During solar eclipse, the Moon comes in between the Earth and the Sun. What is the distance between the Moon and the Sun at that particular time?

94. A particular star is at a distance of about 8.1 x 10^{13} km from the Earth. Assuring that light travels at 3 x 10^8 m per second, find how long does light takes from that star to reach the Earth?

95. By what number should $(-5)^{-1}$ be divided so that the quotient may be equal to $(-5)^{-1}$?

96. **By what number should $(-8)^{-3}$ .be multiplied so that the product may be equal to $(-6)^{-3}$?**

97. If a = – 1, b = 2,-then find the value of the following,

(i) $a^b + b^a$ (ii) $a^b - b^a$

(iii) $a^b \times b^a$ (iv) $a^b \div b^a$

97. **Express each of the following in exponential form.**

(i) $\frac{-1296}{14641}$ (ii) $\frac{-125}{343}$

(iii) $\frac{400}{3969}$ (iv) $\frac{-625}{10000}$

98. **Simplify**

(i) $\left[\left(\frac{1}{2}\right)^2 - \left(\frac{1}{4}\right)^3\right]^{-1} \times 2^{-3}$

(ii) $\left[\left(\frac{4}{3}\right)^{-2} - \left(\frac{3}{4}\right)^2\right]^{(-2)}$

(iii) $\left(\frac{4}{13}\right)^4 \times \left(\frac{13}{7}\right)^2 \times \left(\frac{7}{4}\right)^3$

(iv) $\left(\frac{1}{5}\right)^{45} \times \left(\frac{1}{5}\right)^{-60} - \left(\frac{1}{5}\right)^{28} \times \left(\frac{1}{5}\right)^{-43}$

(v) $\frac{(9)^3 \times 27 \times t^4}{(3)^{-2} \times (3)^4 \times t^2}$

(vi) $\frac{(3^{-2})^2 \times (5^2)^{-3} \times (t^{-3})^2}{(3^{-2})^5 \times (5^3)^{-2} \times (t^{-4})^3}$