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GET Term 2 Take Home Package
Mathematics
Grade 8 Exponents



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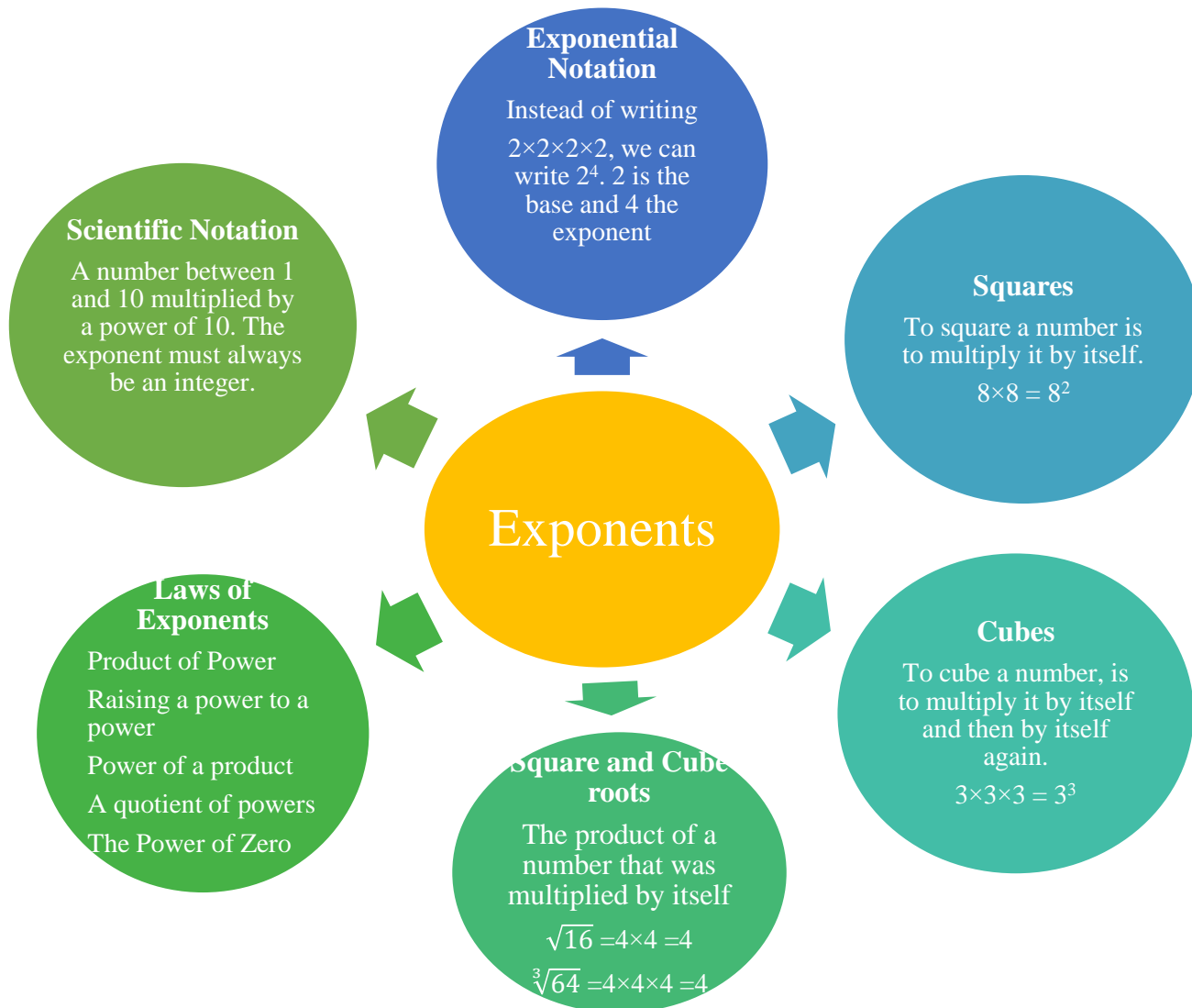
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GRADE 8 MATHEMATICS CONSOLIDATION MODULE: EXPONENTS

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WEST COAST EDUCATION DISTRICT



KEY CONCEPTS:

LAWS OF EXPONENTS:

Product of Power: The base (2) is a repeated factor. The exponents tell us the **number of times** each factor is repeated

- $(2 \times 2) \times (2 \times 2 \times 2)$

$2^2 \times 2^3$ (multiplying two or more powers with the same base, the answer has the same base, but its exponent is **equal to the sum of the exponents**)

$$2^{2+3} = 2^5$$

Raising a power to a power

- $2^4 \times 2^4 \times 2^4 = (2^4)^3$

$$2^{4 \times 3} = 2^{12}$$

Power of a product

- $a^m \times a^n = a^{m+n}$

Quotient of powers

$$3^6 \div 3^3 = 3^{6-3} = 3^3 = 27$$

The power of zero

- Any number raised to the power of 0 is always equal to 1

INSTRUCTIONS:

1. DO ALL THE EXERCISES IN YOUR CLASSWORK BOOK SHOWING YOUR CALCULATIONS
2. NUMBER ACCORDING TO THE QUESTIONS PER WORKSHEET
3. RATHER DO NOT USE A CALCULATOR AS THIS SERVES AS EXTRA PRACTICE
4. FIRST ATTEMPT TO ANSWER ALL THE QUESTIONS BEFORE YOU CHECK ANSWERS IN THE MEMORANDA



ENJOY!!

WORKSHEET 1:

Question 1:

1.1 Write the following in exponential form

1.1.1 $2 \times 2 \times 2 =$

1.1.2 $3 \times 3 \times 3 =$

1.1.3 $4 \times 4 \times 4 \times 4 =$

1.1.4 $6 \times 6 \times 6 \times 6 \times 6 =$

1.2 Calculate the following:

1.2.1 $5^2 =$

1.2.2 $2^5 =$

1.2.3 $3^4 =$

1.2.4 $4^3 =$

Question 2

2.1 Complete the following table:

Number	Square the number	Exponential Form	Square
e.g 5	5×5	5^2	25
7			
4			
8			
10			

2.2 Calculate the following:

2.2.1 $3^2 \times 4^2 = \dots\dots^2$

WORKSHEET 2:

Question 1:

1.1 Calculate the following and justify your answer:

1.1.1 $\sqrt{100} =$

1.1.2 $\sqrt{64} =$

1.1.3 $\sqrt{125} =$

1.1.4 $\sqrt{81} =$

Question 2

2.1 Complete the following table:

Number	Cube the number	Exponential Form	Cube
e.g. 2	$2 \times 2 \times 2$	2^3	8
4			
5			
7			
9			

2.2 Which of the following statements are true? Rewrite the false statements to be true

2.2.1 $2^3 \times 3^3 = 6^3$

2.2.2 $2^3 \times 5^3 = 7^3$

2.2.3 $2^3 \times 4^3 = 8^3$

2.2.4 $1^3 \times 9^3 = 10^3$

$$2.2.2 \quad 2^2 \times 5^2 = \dots\dots^2$$

$$2.2.3 \quad 2^2 \times 4^2 = \dots\dots^2$$

$$2.2.4 \quad 2^2 \times 3^2 = \dots\dots^2$$

WORKSHEET 3:

Question 1:

1.1 Calculate the following and give reasons for your answers:

$$1.1.1 \quad \sqrt[3]{729}$$

$$1.1.2 \quad \sqrt[3]{216}$$

$$1.1.3 \quad \sqrt[3]{125}$$

$$1.1.4 \quad \sqrt[3]{1\,000}$$

1.2 Calculate each of the following without using a calculator:

$$1.2.1 \quad -2^3 =$$

$$1.2.2 \quad (-2)^2 =$$

$$1.2.3 \quad (-5)^3 =$$

$$1.2.4 \quad -5^3 =$$

$$1.2.5 \quad (-2)^6 =$$

$$1.2.6 \quad (-3)^4 =$$

Question 2

2.1 Express the following as a product of the powers of 2 as indicated by the brackets:

$$2.1.1 \quad (2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2)$$

$$2.1.2 \quad (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2)$$

$$2.1.3 \quad (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2)$$

2.2 Simplify the following:

$$2.2.1 \quad x^7 \times x^3 =$$

$$2.2.2 \quad x^2 \times x^4 =$$

$$2.2.3 \quad x^8 \times x^2 =$$

$$2.2.4 \quad x^1 \times x^7 =$$

WORKSHEET 4:

Question 1:

1.1 Complete the table:

x	1	2	3	4	5
2^x	$2^1 = 2$				
3^x		$3^2 = 9$			
6^x			$6^3 = 216$		

1.2 Use the table above to answer the questions below. Are these statements true or false? Rewrite the false statements to be true.

$$1.2.1 \quad 6^2 = 2^2 \times 3^2$$

$$1.2.2 \quad 6^3 = 2^3 \times 3^3$$

$$1.2.3 \quad 6^5 = 2^5 \times 3^5$$

$$1.2.4 \quad 6^8 = 2^4 \times 3^4$$

Question 2

2.1 Write the following expressions as expressions with one base:

$$2.1.1 \quad 3^2 \times 5^2 =$$

$$2.1.2 \quad 7^4 \times 4^4 =$$

$$2.1.3 \quad 2^3 \times 6^3 =$$

$$2.1.4 \quad 5^2 \times 7^2 =$$

2.2 Give the value of the following:

$$2.2.1 \quad 3^4$$

$$2.2.2 \quad 2^5$$

$$2.2.3 \quad 5^6$$

2.3 Calculate the following:

$$2.3.1 \quad 3^6 \div 3^3$$

Question 3

3.1 Complete the following table:

x	1	2	3	4	5	6	7
2^x	2	4					
	2^1	2^2					

3.2 Complete the table:

Product of power	Power of power notation	Total number of repetition	Simplified form	Value
$2^4 \times 2^4 \times 2^4$	$(2^4)^3$	12	2^{12}	4096
$3^2 \times 3^2 \times 3^2 \times 3^2$				
$2^3 \times 2^3 \times 2^3 \times 2^3 \times 2^3$				
$3^4 \times 3^4 \times 3^4$				
$2^6 \times 2^6 \times 2^6$				

3.3.1 Can $(2^3) \times (2^3) \times (2^3)$ be expressed as $(2^3)^3$? Explain.

3.3.2 Is $(2^3)^5 = 2^{3+5}$ or is $(2^3)^5 = 2^{3 \times 5}$? Explain.

3.4 Simplify the following:

3.4.1 $(5^4)^5$

3.4.2 $(10^4)^5$

3.4.3 $(6^4)^4$

3.4.4 $(5^4)^{10}$

2.3.2 $6^{17} \div 6^{14}$

2.3.3 $10^{20} \div 10^{14}$

Question 3

3.1 Simplify

3.1.1 $3^3 + \sqrt[3]{-27} \times 2$

3.1.2 $5 \times (2 + 3) + (-1)^0$

3.1.3 $\frac{\sqrt[3]{1000}}{\sqrt{100}} + (4 - 1)^2$

3.1.4 $4^3 \div 2^3 + \sqrt{144}$

3.1.5 $(2^2 \times 4)^2 + \frac{6^2}{3^2}$

3.2 Complete the table:

Fraction	Writing fraction as a product of squares	Square root
$\frac{8}{121}$		
$\frac{64}{81}$		
$\frac{49}{169}$		
$\frac{100}{225}$		

3.3 Calculate:

3.3.1 $\left(\frac{2}{5}\right)^2$

3.3.2 $\left(\frac{2}{3}\right)^3$

3.3.3 $\left(\frac{5}{10}\right)^3$

WORKSHEET 5:

Question 1

Express each of the following as a single number. Do not use a calculator:

1.1 3.45×10

1.2 2.34×10^2

1.3 $10^4 \times 10^2$

1.4 $10^0 \times 10^6$

1.5 $3,4 \times 10^5$

Question 2

Write the following in scientific notation:

2.1 367 000 000

2.2 21 900 000

2.3 600 000 000 000

2.4 178

Question 3

Answer the following questions:

3.1 The universe is 15 000 000 000 years old. Express the age of the universe in scientific notation.

3.2 The average distance from the earth to the sun is 149 600 000. Express this distance in scientific notation.

3.3 Explain why the number 24×10^3 is not in scientific notation.

3.4 The first birds appeared on earth about 208 000 000 years ago. Write this number in scientific notation.

3.5 Write 3×10^9 in the ordinary way.

3.6 If the planet Jupiter is 800 million km from earth, and it was possible for you to travel from earth to Jupiter and back, how far would you have travelled? Express your answer in scientific notation.

WORKSHEET 1 MEMORANDUM

Question 1

1.1.1 $2 \times 2 \times 2 = 2^3$

1.1.2 $3 \times 3 \times 3 = 3^3$

1.1.3 $4 \times 4 \times 4 \times 4 = 4^4$

1.1.4 $6 \times 6 \times 6 \times 6 \times 6 = 6^5$

1.2.1 $5^2 = 5 \times 5 = 25$

1.2.2 $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

1.2.3 $3^4 = 3 \times 3 \times 3 \times 3 = 81$

1.2.4 $4^3 = 4 \times 4 \times 4 = 64$

Question 2

2.1

Number	Square the number	Exponential Form	Square
e.g 5	5×5	5^2	25
7	7×7	7^2	49
4	4×4	4^2	16
8	8×8	8^2	64
10	10×10	10^2	100

2.2.1 $3^2 \times 4^2 = 12^2$

2.2.2 $2^2 \times 5^2 = 10^2$

2.2.3 $2^2 \times 4^2 = 8^2$

2.2.4 $2^2 \times 3^2 = 8^2$

WORKSHEET 2: MEMORANDUM

Question 1

1.1.1 $\sqrt{100} = 10$, because $10 \times 10 = 100$

1.1.2 $\sqrt{64} = 8$, because $8 \times 8 = 64$

1.1.3 $\sqrt{144} = 12$, because $12 \times 12 = 144$

1.1.4 $\sqrt{81} = 9$, because $9 \times 9 = 81$

Question 2

2.1

Number	Cube the number	Exponential Form	Cube
e.g. 2	$2 \times 2 \times 2$	2^3	8
4	$4 \times 4 \times 4$	4^3	64
5	$5 \times 5 \times 5$	5^3	125
7	$7 \times 7 \times 7$	7^3	343
9	$9 \times 9 \times 9$	9^3	729

2.2.1 $2^3 \times 3^3 = 6^3$ True

2.2.2 $2^3 \times 5^3 = 7^3$ False, $2^3 \times 5^3 = 10^3$

2.2.3 $2^3 \times 4^3 = 8^3$ True

2.2.4 $1^3 \times 9^3 = 10^3$ False, $1^3 \times 9^3 = 9^3$

WORKSHEET 3: MEMORANDUM

WORKSHEET 4: MEMORANDUM

Question 1

- 1.1.1 $\sqrt[3]{125} = 5$, because $5 \times 5 \times 5 = 125$
- 1.1.2 $\sqrt[3]{216} = 6$, because $6 \times 6 \times 6 = 216$
- 1.1.3 $\sqrt[3]{729} = 9$, because $9 \times 9 \times 9 = 729$
- 1.1.4 $\sqrt[3]{1\,000} = 10$, because $10 \times 10 \times 10 = 1\,000$

- 1.2.1 $-2^3 = -2 \times -2 \times -2 = -8$
- 1.2.2 $(-2)^2 = -2 \times -2 = 4$
- 1.2.3 $(-5)^3 = -5 \times -5 \times -5 = -125$
- 1.2.4 $-5^3 = -5 \times -5 \times -5 = -125$
- 1.2.5 $(-2)^6 = -2 \times -2 \times -2 \times -2 \times -2 \times -2 = 64$
- 1.2.6 $(-3)^4 = -3 \times -3 \times -3 \times -3 = 81$

Question 2

- 2.1.1 $(2 \times 2 \times 2) \times (2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2) = 2^3 \times 2^9$
- 2.1.2 $(2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) \times (2 \times 2) = 2^2 \times 2^2 \times 2^2 \times 2^2 \times 2^2$
- 2.1.3 $(2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) \times (2 \times 2 \times 2) = 2^3 \times 2^3 \times 2^3 \times 2^3$

- 2.2.1 $x^7 \times x^3 = x^{7+3} = x^{10}$
- 2.2.2 $x^2 \times x^4 = x^{2+4} = x^6$
- 2.2.3 $x^8 \times x^2 = x^{8+2} = x^{10}$
- 2.2.4 $x^1 \times x^7 = x^{1+7} = x^8$

Question 3.1

x	1	2	3	4	5	6	7
2^x	2	4	8	16	32	64	128
	2^1	2^2	2^3	2^4	2^5	2^6	2^7

Question 1

1.1

x	1	2	3	4	5
2^x	$2^1 = 2$	$2^2 = 4$	$2^3 = 8$	$2^4 = 16$	$2^5 = 32$
3^x	$3^1 = 3$	$3^2 = 9$	$3^3 = 27$	$3^4 = 81$	$3^5 = 243$
6^x	$6^1 = 6$	$6^2 = 36$	$6^3 = 216$	$6^4 = 1\,296$	$6^5 = 7\,776$

- 1.2.1 $6^2 = 2^2 \times 3^2$ True
- 1.2.2 $6^3 = 2^3 \times 3^3$ True
- 1.2.3 $6^5 = 2^5 \times 3^5$ True
- 1.2.4 $6^8 = 2^4 \times 3^4$ False, $2^4 \times 3^4 = 6^4$

Question 2

- 2.1.1 $3^2 \times 5^2 = (3 \times 5)^2 = 15^2$
- 2.1.2 $7^4 \times 4^4 = (7 \times 4)^4 = 28^4$
- 2.1.3 $2^3 \times 6^3 = (2 \times 6)^3 = 12^3$
- 2.1.4 $5^2 \times 7^2 = (5 \times 7)^2 = 35^2$

- 2.2.1 $3^4 = 3 \times 3 \times 3 \times 3 = 81$
- 2.2.2 $2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$
- 2.2.3 $5^6 = 5 \times 5 \times 5 \times 5 \times 5 \times 5 = 15\,625$

- 2.3.1 $3^6 \div 3^3 = 3^{6-3} = 3^3 = 27$
- 2.3.2 $6^{17} \div 6^{14} = 6^{17-14} = 6^3 = 216$
- 2.3.3 $10^{20} \div 10^{14} = 10^{20-14} = 10^6 = 1\,000\,000$

3.2

Product of power	Power of power notation	Total number of repetition	Simplified form	Value
$2^4 \times 2^4 \times 2^4$	$(2^4)^3$	12	2^{12}	4 096
$3^2 \times 3^2 \times 3^2 \times 3^2$	$(3^2)^4$	8	3^8	6 561
$2^3 \times 2^3 \times 2^3 \times 2^3 \times 2^3$	$(2^3)^5$	15	2^{15}	32 768
$3^4 \times 3^4 \times 3^4$	$(3^4)^3$	12	3^{12}	531 441
$2^6 \times 2^6 \times 2^6$	$(2^6)^3$	18	2^{18}	262 144

3.3.1 Yes, (2^3) is actually $(2^3)^1$ which is $= 2^3$

3.3.2 $2^{3 \times 5}$, the law of raising a power to a power

3.4.1 $(5^4)^5 = 5^{4 \times 5} = 5^{20}$

3.4.2 $(10^4)^5 = 10^{4 \times 5} = 10^{20}$

3.4.3 $(6^4)^4 = 6^{4 \times 4} = 6^{16}$

3.4.4 $(5^4)^{10} = 5^{4 \times 10} = 5^{40}$

Question 3

$$\begin{aligned}
 3.1.1 \quad & 3^3 + \sqrt[3]{-27} \times 2 \\
 & = 27 + (-3) \times 2 \\
 & = 27 - 6 \\
 & = 21
 \end{aligned}$$

$$\begin{aligned}
 3.1.2 \quad & 5 \times (2 + 3) + (-1)^0 \\
 & = 5 \times 5^2 + 1 \\
 & = 125 + 1 \\
 & = 126
 \end{aligned}$$

$$\begin{aligned}
 3.1.3 \quad & \frac{\sqrt[3]{1000}}{\sqrt{100}} + (4 - 1)^2 \\
 & = \frac{10}{10} + 3^2 \\
 & = 1 + 9 \\
 & = 10
 \end{aligned}$$

$$\begin{aligned}
 3.1.4 \quad & 4^3 \div 2^3 + \sqrt{144} \\
 * \quad & = 2^6 \div 2^3 + \sqrt{144} \\
 & = 2^{6-3} + 12 \\
 & = 2^3 + 12 \\
 & = 8 + 12 \\
 & = 20
 \end{aligned}$$

**Note: (write the expression in exponential form with a base of 2)*

$$\begin{aligned}
 3.1.5 \quad & (2^2 \times 4)^2 + \frac{6^2}{3^2} \\
 & = (2^2 \times 2^2)^2 + 2^2 \times 3^2 \div 3^2 \\
 & = (2^4)^2 + 2^2 \\
 & = 2^8 + 2^2 \\
 & = 256 + 4 \\
 & = 260
 \end{aligned}$$

3.2

Fraction	Writing fraction as a product of squares	Square root
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$\frac{81}{121}$	$\frac{9}{11} \times \frac{9}{11}$	$\sqrt{\frac{81}{121}} = \frac{9}{11}$
$\frac{64}{81}$	$\frac{8}{9} \times \frac{8}{9}$	$\sqrt{\frac{64}{81}} = \frac{8}{9}$
$\frac{49}{169}$	$\frac{7}{13} \times \frac{7}{13}$	$\sqrt{\frac{49}{169}} = \frac{7}{13}$
$\frac{100}{225}$	$\frac{10}{15} \times \frac{10}{15}$	$\sqrt{\frac{100}{225}} = \frac{10}{15}$

$$3.3.1 \left(\frac{2}{5}\right)^2 = \frac{2}{5} \times \frac{2}{5} = \frac{4}{25}$$

$$3.3.2 \left(\frac{2}{3}\right)^3 = \frac{2}{3} \times \frac{2}{3} \times \frac{2}{3} = \frac{8}{27}$$

$$3.3.3 \left(\frac{5}{10}\right)^3 = \frac{5}{10} \times \frac{5}{10} \times \frac{5}{10} = \frac{125}{1\,000}$$

WORKSHEET 5: MEMORANDUM

Question 1

1.1 $3,45 \times 10 = 34,5$

1.2 $2,34 \times 10^2 = 234$

1.3 $10^4 \times 10^2 = 10^6 = 1\,000\,000$

1.4 $10^0 \times 10^6 = 1 \times 1\,000\,000 = 1\,000\,000$

1.5 $3,2 \times 10^5 = 340\,000$

Question 2

2.1 $367\,000\,000 = 3,67 \times 10^8$

2.2 $21\,900\,000 = 2,19 \times 10^7$

2.3 $600\,000\,000\,000 = 6 \times 10^{11}$

2.4 $178 = 1,78 \times 10^2$

Question 3

3.1 $1,5 \times 10^{10}$ years

3.2 $1,496 \times 10^8$ km

3.3 24 is not a number between 1 and 10

3.4 $2,08 \times 10^8$

3.5 3 000 000 000

3.6 $2 \times 800\,000\,000$

= 1 600 000 000

= $1,6 \times 10^9$ km