## Form Three Mathematics Test (2023–2024)
### Ch.2 Laws of Integral Indices

Class:  F . 3 (    )          Name: _____ (    )

| | | Class | |
|---|---|---|---|
| **Mark** | **/40** | Average | |
| **Parent's Signature:** | | | |

Time Allowed: 35 minutes

Date: 3/10/2023

**Unless specified, the figures are not necessary drawn to scale.**

**Section A: Multiple Choice (10 marks)**

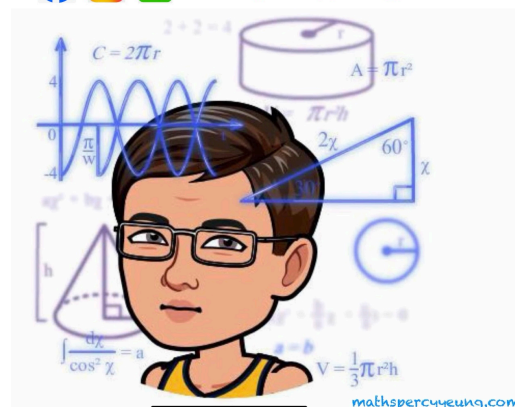Put the best answer in the spaces provided in the box below.

| Question | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| Answer | | | | | |

1.    $\dfrac{24^n}{2^{3n}} =$

     **A.**    3

     **B.**    $3^n$

     **C.**    $12^n$

     **D.**    $\dfrac{1}{12^{2n}}$

2.    It is given that $a$ and $b$ are non-zero numbers and $x$ is an integer. Which of the following must be true?

     I.    $a^{-2x} = \dfrac{1}{a^{2x}}$

     II.    $2a^x + a^x = 2a^{2x}$

     III.    $\left(\dfrac{a}{b}\right)^{-2x} = \dfrac{b^{2x}}{a^{2x}}$

     **A.**    I and II only

     **B.**    I and III only

     **C.**    II and III only

     **D.**    I, II and III

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**3.** If $3^{1000} + 3^{1001} + 3^{1002} + 3^{1003} = a \times 3^{1000}$, then $a =$
   **A.** 40.
   **B.** 41.
   **C.** 42.
   **D.** 43.

**4.** Which of the following numbers is the smallest?
   **A.** $5.5 \times 10^{33}$
   **B.** $5.5 \times 10^{-33}$
   **C.** $-5.5 \times 10^{33}$
   **D.** $-5.5 \times 10^{-33}$

**5.** $10100001001_2 =$
   **A.** $2^{10} + 2^8 + 2^3 + 1$
   **B.** $2^{10} + 2^8 + 2^3 + 2$
   **C.** $2^{11} + 2^9 + 2^4 + 1$
   **D.** $2^{11} + 2^9 + 2^4 + 2$

## Section B: Short Questions (12 marks)

|     | Question | Answer |
|-----|----------|--------|
| 6.  | Simplify the following and express answers with positive indices. | |
|     | (a) $(4h^5)^3$ | |
|     | (b) $(-7y^8)^2$ | |
|     | (c) $(m^5n^{-4})^{-3}$ | |
|     | (d) $\left(\dfrac{e^0}{2f^{-3}}\right)^{-2}$ | |
| 7.  | Determine whether each of the following statements is true(T) or false(F). | |
|     | (a) $32 \times 10^{12}$ is expressed in scientific notation. | |
|     | (b) $0.375 \times 10^2$ is expressed in scientific notation. | |
|     | (c) $1.52 \times 10^{-53}$ is expressed in scientific notation. | |
|     | (d) $-2.0374 \times 10^{20}$ is expressed in scientific notation. | |
| 8.  | (a) The distance between the earth and the sun is about 149 000 000 km. Use scientific notation to represent this distance. | |
|     | (b) The time for a computer to execute one instruction is about 0.000 021 s. Use scientific notation to represent this time. | |
| 9.  | Write each of the following expressions as a binary number. <br> (a) $1 \times 2^5 + 1 \times 2^2 + 1 \times 2$ <br> (b) $2^7 + 2^4 + 2^3 + 1$ | |

## Section C: Long Questions (18 marks)

10. Simplify the following and express answers with positive indices.

(a) $8b^7 \times b^3 \div 2b^4$ (2 marks)

(b)  $\dfrac{6v^6}{4v \times 3v^8}$  (2 marks)

(c)  $\dfrac{27(m^4 n^{-3})^{-3}}{(3m^2 n^4)^2}$  (3 marks)

(d)  $\dfrac{(x+2y)^0 (x^3 y)^{-2}}{x^{-3}}$  (3 marks)

11.  Given that $n$ is a positive integer, simplify the following expressions.

(a)  $5^{n+4} \times 25^{n+2}$  (3 marks)

(b) $\dfrac{3^{-3} \times 27^{1-n}}{81^{2n}}$ (3 marks)

12. Convert $48_{10}$ into binary numbers. Steps should be shown clearly. (2 marks)

**Section D: Bonus (2 marks) Only answers are required.**

Convert $15 \times 2^9 + 2^7 + 9 \times 2^2 - 2^2$ into binary number.