

INTERNATIONAL BACCALAUREATE  
Mathematics: applications and interpretation

**MAI**

**EXERCISES [MAI 1.2-1.3]**  
**EXPONENTS – SYSTEMS OF LINEAR EQUATIONS**

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**A. Paper 1 questions (SHORT)**

**EXPONENTS**

1. [Maximum mark: 15] **[try to solve without GDC]**

Find the following values in the form of an integer or a fraction  $\frac{a}{b}$  of integers

$3^3 =$	$3^{-2} =$	$3^{-3} =$
$\left(\frac{1}{3}\right)^2 =$	$\left(\frac{2}{3}\right)^2 =$	$\left(\frac{2}{3}\right)^3 =$
$\left(\frac{1}{3}\right)^{-2} =$	$\left(\frac{2}{3}\right)^{-2} =$	$\left(\frac{2}{3}\right)^{-3} =$
$4^{\frac{1}{2}} =$	$4^{\frac{3}{2}} =$	$4^{-\frac{1}{2}} =$
$25^{\frac{1}{2}} =$	$25^{-\frac{1}{2}} =$	$\left(\frac{25}{4}\right)^{\frac{1}{2}} =$

2. [Maximum mark: 6] **[try to solve without GDC]**

Find the following values in the form of an integer or a fraction  $\frac{a}{b}$  of integers

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

3. [Maximum mark: 9] **[try to solve without GDC]**

Find the following values in the form of an integer or a fraction  $\frac{a}{b}$  of integers

$\frac{30^2}{15^2} =$	$\frac{15^{-2}}{30^{-2}} =$	$\frac{12^{\frac{1}{2}}}{3^{\frac{1}{2}}} =$
$7^{0.3} \times 7^{0.7} =$	$7^{\frac{1}{2}} \times 7^{\frac{3}{2}} =$	$7^{-2} \times 7 =$
$7^2 \times 7^{-1} =$	$\frac{2^3 \times 3^3}{6^3} =$	$\frac{4^3 \times 3^3}{6^3} =$

4. [Maximum mark: 15]

Express the following in the form of a single power ( $x^y$ )

$a^6 a^2 =$	$a^6 a =$	$(a^{\frac{1}{2}})^6 =$
$(a^6)^2 =$	$(a^2)^6 =$	$\frac{a^6}{a^2} =$
$a^2 a^3 a =$	$\frac{a^2 a^6}{a^5} =$	$\frac{a^2 b^6}{b^2 a^{-3} b^4} =$
$\left(a^{\frac{3}{5}}\right)^5 =$	$\left(a^{\frac{3}{5}}\right)^{10} =$	$(a^{-1})^2 =$
$a^{x+3} a^{1-x} =$	$\frac{a^{n+5}}{a^{n+3}} =$	$\frac{a^{-8}}{a^{-10}} =$

5. [Maximum mark: 8]

Given that  $A > 0$ ,  $B > 0$ ,  $C > 0$ , simplify the expressions

$\frac{A^6 B^3 C^{10}}{C^5 A^2 B} =$
$\frac{A^2 B + AB^3}{AB} =$
$\frac{2A + A(4B) + (2A)^2}{2A} =$
$\frac{A^4 B^3 + A^3 B^4}{A + B} =$

6. [Maximum mark: 9]

Give the following values correct to 3 significant figures

$e =$	$\pi =$
$2e =$	$2\pi =$
$e^2 =$	$\pi^2 =$
$\sqrt{e} =$	$\frac{\pi}{e} =$
$\sqrt[3]{e^2} =$	$\frac{e}{\pi} =$

7. [Maximum mark: 9]

Match the following

- |                      |                          |
|----------------------|--------------------------|
| 1. $e^{-2}$          | (a) $(e^x)^2$            |
| 2. $e^{\frac{1}{2}}$ | (b) $\frac{1}{e^x}$      |
| 3. $e^x$             | (c) $\frac{e^{2x}}{e^x}$ |
| 4. $e^{-x}$          | (d) $\frac{1}{e^2}$      |
| 5. $e^{\frac{x}{2}}$ | (e) $\sqrt{e}$           |
| 6. $e^{2x}$          | (f) $\frac{e^x}{e^{-2}}$ |
| 7. $e^{x+2}$         | (g) $\sqrt{e^x}$         |

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10. [Maximum mark: 5] ***[try to solve without GDC]***

Find the **exact** solution of the equation  $9^{2x} = 27^{(1-x)}$ .

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11. [Maximum mark: 4] ***[try to solve without GDC]***

Solve the equation  $9^{x-1} = \left(\frac{1}{3}\right)^{2x}$

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**SYSTEMS OF LINEAR EQUATIONS**

**12.** [Maximum mark: 4]

Solve the systems of linear equations

(a)  $3.2x - 5.6y = -26.4$

(b)  $13a + 12b = 104.5$

$1.1x + 2.7y = 23.3$

$14a - 5b = 28.3$

[2+2]

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**13.** [Maximum mark: 5]

Solve the systems of linear equations

(a)  $3x - 7y + z = -39$

(b)  $5a + 7b = 19$

$7x + 2y - z = 44$

$8b - 3c = 7$

$-x + 7y - 5z = 55$

$9a + 4c = 21$

[2+3]

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**14.** [Maximum mark: 3]

Solve the system of linear equations

$3x + 7y = 41$

$5y - 2x = 21$

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15. [Maximum mark: 3]

Consider the expression

$$P = ax^2 + bx + 3$$

For  $x = 5$ ,  $P$  takes the value 88. For  $x = -7$ ,  $P$  takes the value 52

Find the values of  $a$  and  $b$ .

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16. [Maximum mark: 7]

The sum of three integers  $A$ ,  $B$  and  $C$  is 20. The sum of  $2A$  and  $3B$  is 41.

The value of  $A$  is 7 more than the value of  $C$ .

- (a) Write down 3 linear equations in  $A$ ,  $B$ ,  $C$  [2]
- (b) Find the numbers  $A$ ,  $B$  and  $C$ . [3]
- (c) Confirm the results [2]

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