Year 10 Math Methods

2023 Semester 1

Indices, Surds, Logarithms & Algebra Skills CAT

Student Name: _____

Writing time: 40 minutes

Total marks: 35

Materials allowed: General Stationary (pens, pencils, rulers etc)

Instructions:

- **For questions worth more than one-mark, full working out must be shown.**
- **Unless otherwise stated, exact answers must be used**

PART A: Multiple Choice

- Place your answer into the table at the end of this section
- No working needs to be shown.
- Each correct answer is worth 1 mark

	Questions	**Working Space if Required**
1	The number $0.\overline{159261}$ is: A A natural number B An integer C A rational number D An irrational number E An imaginary number	
2	When simplified $\frac{12xy^6}{9x^2} \times \frac{3(x^5y^2)^0}{y^4}$ becomes: A $6xy^2$ B $\frac{4y^2}{x}$ C $\frac{4y^2}{3x}$ D $4xy^2$ E $\frac{2y^2}{3x^2}$	
3	When simplified, $\left(\frac{4a^{-2}}{5b^{-1}}\right)^{-3}$ becomes: A $\frac{4a^6}{5b^3}$ B $\frac{125a^6}{64b^3}$ C $\frac{64b^3}{125a^6}$ D $\frac{64a^6}{125b^3}$ E $\frac{4a^6}{5b^3}$	

4	When fully simplified, $\sqrt{96} + 5\sqrt{24}$ is equal to: A $7\sqrt{24}$ B $6\sqrt{3} + 10\sqrt{6}$ C $9\sqrt{6}$ D $9\sqrt{24}$ E $14\sqrt{6}$	
5	$\frac{5}{2+\sqrt{3}}$ when expressed with a rational denominator is equal to: A $10 + 5\sqrt{3}$ B $\frac{10+5\sqrt{3}}{7}$ C $10 - \sqrt{3}$ D $10 - 5\sqrt{3}$ E $\sqrt{3}$	
6	$3\log_{10}(a) + \log_{10}(b) - \log_{10}(c)$ is equivalent to: A $\mathbf{log_{10}}\left(\frac{a^3b}{c}\right)$ B $\mathbf{3log}(a+b-c)$ C $\mathbf{3log_{10}}\left(\frac{ab}{c}\right)$ D $\mathbf{log_{10}}(a^3+b-c)$ E $\mathbf{log_{10}}\left(\frac{3ab}{c}\right)$	
7	The expression $\frac{2x+3}{4} - \frac{x-1}{2}$ simplifies to: A $\frac{x-2}{2}$ B $\frac{x+5}{4}$ C $\frac{5}{4}$ D $\frac{x+4}{4}$ E $\frac{1}{4}$	

8	Evaluate the expression $(3abc^3)^3$, when $a = -1, b = 2$, and $c = 1$ A 54 B 216 C 81 D -200 E -216	
9	Solve for x: $\frac{x}{5} - \frac{1}{7} = \frac{1}{35}$ A $x = 4$ B $x = \frac{4}{7}$ C $x = 6$ D $x = \frac{6}{7}$ E $x = -\frac{4}{7}$	
10	Solve for y: $\log_{10}(x-2) - 3\log_{10}(x) = -\log_{10} y$ A $\frac{x^3}{x-2}$ B $\frac{x-2}{x^3}$ C $-\frac{x-2}{x^3}$ D $2x + 2$ E $\frac{1}{2x+2}$	

Q1	Q2	Q3	Q4	Q5
Q6	**Q7**	**Q8**	**Q9**	**Q10**

PART B: Short Answer

- You must show full working for any questions worth more than one mark

Question 1

a) Simplify and write in index form:
$\left(\sqrt{4x}\right)^3$

b) Simplify and write in surd form:
$(16a^2)^{\frac{1}{4}}$

(1+1 = 2 marks)

Question 2

Simplify the following:

a) $(m^6n^3)^{\frac{1}{3}} \div \left(m^{-\frac{1}{2}}n^3\right)^2$

b) $2\sqrt{6} \times 4\sqrt{3}$

c) $\frac{x+2}{2} + \frac{x-6}{3}$

d) $\frac{2}{x+3} \times \frac{x+7}{8} \div \frac{12(x+7)}{x+3}$

(2+2+2+3 = 9 marks)

Question 3

Solve for x:

a) $\frac{3x}{5} + 6 = 0$

b) $2(4x + 12) = 5(3x - 5)$

(2+3 = 5 marks)

Question 4

a) Transpose the formula $a = \sqrt{\frac{3V}{h}}$ to make V the subject

b) Hence or otherwise, find the value of V when $a = 3$ and $h = 4$.

(2+2 = 4 marks)

Question 5

a) Find the positive value of x, if $\log_x 64 = 2$

b) Solve for x: $\log_2(4x - 2) = \log_2(2x - 1) + x$

(2+3 = 5 marks)

END OF TEST

Formula Sheet

Index Laws:

1) $a^m \times a^n = a^{m+n}$
2) $a^m \div a^n = a^{m-n}$
3) $a^0 = 1$
4) $(a^m)^n = a^{mn}$
5) $(ab)^m = a^m \times b^m$
6) $\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
7) $a^{-m} = \frac{1}{a^m}$
8) $a^{\frac{1}{m}} = \sqrt[m]{a}$

Logarithm Laws:

1) $\log_a(xy) = \log_a(x) + \log_a(y)$
2) $\log_a\left(\frac{x}{y}\right) = \log_a(x) - \log_a(y)$
3) $\log_a(x^n) = n\log_a(x)$
4) $\log_a(1) = 0$
5) $\log_a(a) = 1$
6) $\log_a\left(\frac{1}{x}\right) = -\log_a(x)$
7) $\log_a(a^x) = x$