Year 10 Math Methods

2023 Semester 1

Indices, Surds, Logarithms & Algebra Skills CAT

Student Name: Solutions

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 $\frac{2y^2}{3x^2}$	$\frac{36xy^6}{9x^2y^4} = \frac{4y^2}{x}$
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 $\frac{4a^6}{5b^3}$	$\frac{125}{64} \times \frac{a^6}{b^3}$

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 $14\sqrt{6}$	$\sqrt{16\times6}+5\sqrt{4\times6}$ $=4\sqrt{6}+10\sqrt{6}$
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 $\sqrt{3}$	$\frac{5(2-\sqrt{3})}{4-3}=10-5\sqrt{3}$
6	$3\log_{10}(a)+\log_{10}(b)-\log_{10}(c)$ is equivalent to: A $\log_{10}\left(\frac{a^3b}{c}\right)$ B $3\log(a+b-c)$ C $3\log_{10}\left(\frac{ab}{c}\right)$ D $\log_{10}(a^3+b-c)$ E $\log_{10}\left(\frac{3ab}{c}\right)$	$\log_{10}\left(\frac{a^3b}{c}\right)$
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 $\frac{1}{4}$	$\frac{2x+3-(2x-2)}{4}$ $=\frac{5}{4}$

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	$(3(-1)(2)(1)^3)^3$ $= (-6)^3$ $= -216$
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 $x = -\frac{4}{7}$	$\frac{7x-5}{35} = \frac{1}{35}$ $7x = 6$ $x = \frac{6}{7}$.
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 $\frac{1}{2x+2}$	$\log_{10}\left(\frac{x-2}{x^3}\right) = \log_{10}\left(\frac{1}{y}\right)$ $y = \frac{x^3}{x-2}$.

Q1	Q2	Q3	Q4	Q5
C	B	B	E	D
Q6	**Q7**	**Q8**	**Q9**	**Q10**
A	C	E	D	A

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:

$\sqrt{4x}^3$

$= 8x^{\frac{3}{2}}$ (1)

b) Simplify and write in surd form:

$(16a^2)^{\frac{1}{4}}$

$= 2\sqrt{a}$ (1)

(1+1 = 2 marks)

Question 2

Simplify the following:

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

$= \frac{m^2n}{m^{-1}n^6}$ (1)

$= \frac{m^3}{n^5}$ (1)

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

$= 8\sqrt{18}$ (1)

$= 24\sqrt{2}$ (1)

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

$= \frac{3(x+2)+2(x-6)}{6}$ (1)

$= \frac{3x+6+2x-12}{6}$

$= \frac{5x-6}{6}$ (1)

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

$= \frac{2(x+7)}{8(x+3)} \times \frac{(x+3)}{12(x+7)}$ (1) change ÷ to ×

(1) cancelling

$= \frac{1}{48}$ (1)

(Award marks as reasonable)

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

Question 3

Solve for x:

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

$\frac{3x}{5} = -6$ (1)

$3x = -30$

$x = -10$ (1)

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

$8x + 24 = 15x - 25$ (1)

$49 = 7x$ (1)

$x = 7$. (1)

(2+3 = 5 marks)

Question 4

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

$a^2 = \frac{3V}{h}$ (1)

$V = \frac{a^2 h}{3}$ (1)

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

$V = \frac{9 \times 4}{3}$ (1)

$= 12$ (1)

(2+2 = 4 marks)

Question 5

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

$x^2 = 64$ (1)

$x = 8$. (1)

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

$\log_2\left(\frac{4x-2}{2x-1}\right) = x$ (1)

$\log_2\left(\frac{2(2x-1)}{2x-1}\right) = x$

$\log_2(2) = x$ (1)

$x = 1$. (1)

(2+3 = 5 marks)

END OF TEST