Matrix 1 Test: Extended Mark Scheme

1. Types of Number.

$$\left\{ 3.14159,\ 0,\ \pi^2,\ 0.\dot{4}\dot{5},\ \sqrt{-2},\ \frac{2}{7},\ \sqrt{20.25},\ 3^3,\ \sqrt{5.9} \right\}$$

From the above set of numbers, list;

(a) the integers: 0, 3^3 (2 marks)

(b) the rational numbers: 3.14159, $0.\dot{4}\dot{5}$, $\frac{2}{7}$, $\sqrt{20.25}$ (4 marks)

[Note: $0.\dot{4}\dot{5} = \frac{45}{99}$ and $\sqrt{20.25} = 4.5$]

(c) the irrational numbers: π^2, $\sqrt{5.9}$ (2 marks)

(d) the imaginary number: $\sqrt{-2}$ (1 mark)

2. Factors, Multiples and Primes.

(a) List the factors of 180

{ 1, 2, 3, 4, 5, 6, 9, 10, 12, 15, 18, 20, 30, 36, 45, 60, 90, 180 }

(1 mark per 6 factors. Total = 3 marks)

Identify the prime factors: 2, 3, and 5 (1 mark, with no extras.)

(b) Write 180 as a product of its primes using index notation;

Choose 10 x 18 = 180 (for example)

10 = 2 x 5 and 18 = 2 x 9 = 2 x 3 x 3

So, (2 x 5) x (2 x 3 x 3) ≡ $2^2 \times 3^2 \times 5 = 180$

Therefore, $2^2 \times 3^2 \times 5 = 180$ (3 marks)

(c) What is the lowest common multiple of the numbers: 1, 2, 3, 4, 5 and 6?

Deduce the result: 2 and 3 are factors of 6
and 4 and 5 are factors of 20

So the result is the same as the lowest common multiple of 6 and 20.
That is, 60. (1 mark)

3. NEGATIVE INDICES :

Simplify the following leaving your final answers with positive indices only.

(a) $b^{-3} \times b^{-6} = b^{-3+(-6)} = b^{-3-6} = b^{-9} = \frac{1}{b^9}$ (1 mark)

(b) $5\,d^{-2} \times 8\,d^{-4} = 40\,d^{-2+(-4)} = 40\,d^{-6} = \frac{40}{d^6}$ (2 marks)

(c) $4\,v^{-5} \times 7\,v^2 = 28\,v^{-3} = \frac{28}{v^3}$ (2 marks)

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3(d) $w^{-6} z^3 \times 5w z^4 = 5 w^{-5} z^7$ $= 5\frac{z^7}{w^5}$ (3 marks)

(e) $e^9 \div e^3$ $= e^6$ (1 mark)

(f) $m^4 \div m^{10} = m^{-6}$ $= \frac{1}{m^6}$ (1 mark)

(g) $6 p^3 \div p^{-8} = 6 p^{3-(-8)} = 6 p^{3+8}$ $= 6 p^{11}$ (1 mark)

(h) $32a^{-5} b^3 c^{-4} \div 8 a^2 b^{-7} c^4 = 4 a^{-7} b^{10} c^{-8}$ $= 4\frac{b^{10}}{a^7 c^8}$ (3 marks)

(i) $(3 a^4)^{-3} = 3^{-3} a^{-12} = \frac{1}{3^3 a^{12}} = \frac{1}{27 a^{12}}$ (2 marks)

(j) $(p^5 q r^{-4})^{-5} = p^{-25} q^{-5} r^{20} = \frac{r^{20}}{p^{25} q^5}$ (3 marks)

4. FRACTIONAL INDICES:

Simplify the following;

(a) $a^{\frac{1}{4}} \times a^{\frac{2}{3}} = a^{\frac{1}{4}+\frac{2}{3}} = a^{\frac{11}{12}}$ (2 marks)

(b) $e^{\frac{7}{12}} \times e^{\frac{-1}{12}} = e^{\frac{6}{12}} = e^{\frac{1}{2}}$ (2 marks)

(c) $h^{\frac{4}{9}} \div h^{\frac{7}{9}} = h^{\frac{-3}{9}} = h^{\frac{-1}{3}}$ (2 marks)

(d) $b^{\frac{5}{8}} \div b^{\frac{3}{7}} = b^{\frac{5}{8}-\frac{3}{7}} = b^{\frac{11}{56}}$ (2 marks)

(e) $\sqrt[5]{n^{\frac{10}{11}}} = \left(n^{\frac{10}{11}}\right)^{\frac{1}{5}} = n^{\frac{2}{11}}$ (2 marks)

5. STANDARD FORM;

(a) Write 0.00000000525 in standard form

Answer: 5.25×10^{-9} (2 marks)

(b) Write out 7.2×10^{-8} in full

Answer: 0.000000072 (2 marks)

Grand Total = 50 marks