GREENWOOD COLLEGE

Methods 11 Test 1 2017

Indices, Exponential Equations, Significant Figures

Time Allowed: 55 minutes **Total Marks: 52**

Name: _____

Resource Free

ALL working must be shown for full marks.

1. [2, 3, 3, 3 = 11 marks]

Write each in simplest form with positive indices.

a) $\frac{x^3 y^5}{xy^2}$

$x^2 y^3$

b) $3^{4n} \times 9^{2n} \times 27^{3n}$

$3^{4n} \times 3^{4n} \times 3^{9n}$ ✓✓ base 3

3^{17n} ✓ simplify

c) $\frac{3^{n+2}+27}{5 \times 3^n+15}$

$\frac{3^n 3^2 + 3^3}{5(3^n) + 3(5)}$ ✓ base 3

$= \frac{3^2(3^n+3)}{5(3^n+3)}$ ✓ factorising

$= \frac{9}{5}$ ✓ simplifying

d) $2^{\frac{3}{2}} \times 4^{-\frac{1}{4}} \times 16^{-\frac{3}{4}}$

$2^{\frac{3}{2}} \times 2^{-\frac{2}{4}} \times 2^{-3}$ ✓ base 2

$= 2^{\frac{6}{4} - \frac{2}{4} - \frac{12}{4}}$

$= 2^{-2}$ ✓ add indices

$= \frac{1}{4}$ ✓ simplify

2. [4, 3, 3, 3 = 13 marks]

Solve the following exponential equations:

a) $3^{2x-1} \times 9^{x} = 243$

$3^{2x-1} \times 3^{2x} = 3^{5}$ ✓ base 3

$3^{4x-1} = 3^{5}$ ✓ simplify indices

$4x - 1 = 5$ ✓ solve

$x = \frac{3}{2}$ ✓ simplify

b) $5^{-x} = 0.04$

$5^{-x} = \frac{1}{25}$ ✓ decimal to fraction

$5^{-x} = 5^{-2}$ ✓ negative indices

$x = 2$ ✓ solve

c) $\sqrt{(2x - 3)^{3}} = 8$

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

$2x - 3 = 2^{3 \times \frac{2}{3}}$ ✓

$2x - 3 = 4$ ✓

$2x = 7$

$x = \frac{7}{2}$ ✓

d) $2\sqrt[3]{x} = 12$

$\sqrt[3]{x} = 6$ ✓

$x = 6^{3}$ ✓

$x = 216$ ✓

3. [2, 3 = 5 marks]

Estimate the numerical value of the following by rounding to one significant figure

a) 41.79×8.947

40×9 ✓

360 ✓

b) $\dfrac{(6.9^2) - \sqrt[3]{250.047}}{\sqrt{29.16}}$

$\dfrac{7^2 - 6}{5}$ ✓✓

$= \dfrac{43}{5}$ ✓

4. [3, 2, 2, 2 = 9 marks]

Given that $p = 8 \times 10^{-5}$, $q = 2 \times 10^{4}$ and $r = 3 \times 10^{-2}$, determine each of the following giving exact answers in standard form.

a) pqr

$8 \times 10^{-5} \times 2 \times 10^{4} \times 3 \times 10^{-2}$

48×10^{-3} ✓✓

4.8×10^{-2} ✓

b) $\dfrac{pr}{q}$

$\dfrac{8 \times 10^{-5} \times 3 \times 10^{-3}}{2 \times 10^{4}}$

12×10^{-11} ✓

1.2×10^{-10} ✓

c) p - r

$0.0008 - 0.03$ ✓

$= 2.992 \times 10^{-2}$ ✓

$0.03^{2}9\,9\,10$

0.00008

$-\ .02992$

d) q + p

$20000 + 0.0008$ ✓

$2.00000000 8 \times 10^{4}$ ✓

5. [4 marks]

Write each number in scientific notation correct to 3 significant figures.

a) 251 000 2.51×10^5 ✓

b) 4 827 000 4.83×10^6 ✓

c) 0.00708 7.08×10^{-3} ✓

d) 3 millionths 3.00×10^{-6} ✓

6. [4, 6 = 10 marks]

Simplify:

a) $\dfrac{\sqrt{245} - \sqrt{80}}{\sqrt{5}}$

$\dfrac{\sqrt{49 \times 5} - \sqrt{16 \times 5}}{\sqrt{5}}$ ✓factorise of 5

$\dfrac{7\sqrt{5} - 4\sqrt{5}}{\sqrt{5}}$ ✓simplify

$\dfrac{3\sqrt{5}}{\sqrt{5}}$ ✓simplify

3 ✓cancel

b) $\dfrac{3^{3x} - 9^{x+1}}{1 - 3^{2-x}}$

$\dfrac{3^{3x} - 3^{2(x+1)}}{1 - 3^{2-x}}$ ✓base 3

$\dfrac{-3^{2x+2}}{1 - 3^{2-x}}$ ✓✓indices

$\dfrac{3^{3x}\left(1 - 3^{-x+2}\right)}{\left(1 - 3^{2-x}\right)}$ ✓factorise ✓

3^{3x} ✓simplify