

Name _____

Year 9 Indices and Surds Topic Test

Time allowed: 35 minutes.

Write all answers on the question paper.

Show all working.

Question 1

(8 marks)

Simplify fully:

a) $5x^3 \times 3x^5$

b) $xy^2 \times x^5y$

c) $3^8 \div 3^4$

d) $a^6b^2 \div a^4b$

e) $4y^0 \times (5x)^0$

f) $2x^5(3x^4 - x)$

g) $(3x^2)^3 \div 9x$

Question 2

(8 marks)

Simplify the following expressions by rewriting without negative or fractional indices:

(Leave irrational numbers with a $\sqrt{\quad}$ sign) (Show working)

(a) $16^{\frac{3}{2}}$

(b) $20x^2 \div 4x^6$

(c) $(8x^5y^3)^{\frac{1}{3}}$

(d) $2x^{\frac{1}{2}} \div 4x$

Question 3

(2 marks)

Write the following in scientific notation, correct to 3 significant figures:

a) 0.002306

b) 54.010 000

Question 4

(2 marks)

Calculate the following, and write the answer in scientific notation:

a) $1.6 \times 10^{-7} + 8.3 \times 10^{-5}$

b) $5.6 \times 10^{-7} \times 4 \times 10^3$

Question 5

(14 marks)

Simplify fully:

(a) $\sqrt{28}$

(g) $\frac{6\sqrt{2}}{2\sqrt{6} \times 3\sqrt{5}}$

(b) $6\sqrt{7} + 3\sqrt{7}$

(h) $4\sqrt{3}(\sqrt{7} - \sqrt{3})$

(c) $2\sqrt{3} + 4\sqrt{13} - \sqrt{3} + 3\sqrt{13}$

(d) $3\sqrt{x} \times 5\sqrt{x}$

(i) $(\sqrt{2} + 7)(\sqrt{2} - 7)$

(e) $\sqrt{35} \times \sqrt{7}$

(j) $(3\sqrt{y} - 4)^2$

(f) $12\sqrt{15} \div 3\sqrt{5}$

Question 6

(4 marks)

Rationalise the denominators and simplify:

(a) $\frac{4}{5\sqrt{8}}$

(b) $\frac{\sqrt{3}}{\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{3}}$

Question 7

(2 marks)

Express with a rational denominator:

$$\frac{5\sqrt{3}-2}{4+\sqrt{2}}$$

Time allowed: 35 minutes.
 Write all answers on the question paper.
 Show all working.

Total 40

Question 1

Simplify fully:

| | | | |
|--------------------------------|---|---|---|
| a) $5x^2 \times 3x^5 = 15x^7$ | 1 | e) $4y^0 \times (5x)^0 = 4 \times 1 \times 1 = 4$ | 1 |
| b) $xy^2 \times x^2y = x^3y^3$ | 1 | f) $2x^5(3x^4 - x) = 6x^9 - 2x^6$ | 1 |
| c) $3^8 \div 3^4 = 3^4 = 81$ | 1 | g) $(3x^2)^3 \div 9x = 27x^6 \div 9x = 3x^5$ | 2 |
| d) $a^6b^2 \div a^4b = a^2b$ | 1 | | |

(8 marks)

Question 2

Simplify the following expressions by rewriting without negative or fractional indices: each
 (Leave irrational numbers with a $\sqrt{\quad}$ sign) (Show working)

(8 marks)

a) $16^{\frac{3}{2}} = (\sqrt{16})^3 = 4^3 = 64$

c) $20x^2 \div 4x^6 = \frac{20x^2}{4x^6} = 5x^{-4} = 5 \times \frac{1}{x^4} = \frac{5}{x^4}$

b) $(8x^5y^3)^{\frac{1}{3}} = 8^{\frac{1}{3}} \times x^{\frac{5}{3}} \times y = 2y x^{\frac{5}{3}}$
 $= 2y \sqrt[3]{x^5}$

d) $2x^{\frac{1}{2}} \div 4x = \frac{2x^{\frac{1}{2}}}{4x} = \frac{1}{2} \times x^{-\frac{1}{2}} = \frac{1}{2} \times \frac{1}{x^{\frac{1}{2}}} = \frac{1}{2\sqrt{x}}$

8

8

Question 3

Write the following in scientific notation, correct to 3 significant figures:

a) $0.002306 = 2.31 \times 10^{-3}$

b) $54\,010\,000 = 5.40 \times 10^7$

(2 marks)

2

Question 4

Calculate the following, and write the answer in scientific notation:

a) $1.6 \times 10^{-7} + 8.3 \times 10^5 = 8.3 \times 10^5$

b) $5.6 \times 10^{-7} \times 4 \times 10^3 = 2.24 \times 10^{-3}$

(2 marks)

2

Question 5

Simplify fully:

| | | | |
|---|---|--|---|
| (a) $\sqrt{28} = \sqrt{4 \times 7} = 2\sqrt{7}$ | 1 | (g) $\frac{6\sqrt{2}}{2\sqrt{6} \times 3\sqrt{5}} = \frac{6\sqrt{2}}{6 \times \sqrt{2} \times \sqrt{3} \times \sqrt{5}} = \frac{1}{\sqrt{15}}$ | 2 |
| (b) $6\sqrt{7} + 3\sqrt{7} = 9\sqrt{7}$ | 1 | (h) $4\sqrt{3}(\sqrt{7} - \sqrt{3}) = 4\sqrt{21} - 12$ | 1 |
| (c) $2\sqrt{3} + 4\sqrt{13} - \sqrt{3} + 3\sqrt{13} = \sqrt{3} + 7\sqrt{13}$ | 1 | (i) $(\sqrt{2} + 7)(\sqrt{2} - 7) = (\sqrt{2})^2 - 7^2 = 2 - 49 = -47$ | 2 |
| (d) $3\sqrt{x} \times 5\sqrt{x} = 15x$ | 1 | (j) $(3\sqrt{y} - 4)^2 = (3\sqrt{y})^2 - 2 \times 3\sqrt{y} \times 4 + 4^2 = 9y - 24\sqrt{y} + 16$ | 2 |
| (e) $\sqrt{35} \times \sqrt{7} = \sqrt{5 \times 7} \times \sqrt{7} = 7\sqrt{5}$ | 1 | | |
| (f) $12\sqrt{15} \div 3\sqrt{5} = \frac{12 \times \sqrt{3} \times \sqrt{5}}{3\sqrt{5}} = 4\sqrt{3}$ | 2 | | |

(14 marks)

14

(4 marks)

Question 6

Rationalise the denominators and simplify:

$$(a) \frac{4}{5\sqrt{8}} = \frac{4}{5\sqrt{8}} \times \frac{\sqrt{8}}{\sqrt{8}}$$

$$= \frac{4\sqrt{8}}{40}$$

$$= \frac{4 \times 2\sqrt{2}}{40} = \frac{8\sqrt{2}}{40} = \frac{\sqrt{2}}{5}$$

4

$$(b) \frac{\sqrt{3}}{\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{3}}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$$

$$= \frac{\sqrt{6}}{2} + \frac{\sqrt{6}}{3}$$

$$= \frac{3\sqrt{6} + 2\sqrt{6}}{6}$$

$$= \frac{5\sqrt{6}}{6}$$

$$\text{OR } \frac{\sqrt{3}}{\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{3}} = \frac{3+2}{\sqrt{6}}$$

$$= \frac{5}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$$

$$= \frac{5\sqrt{6}}{6}$$

(2 marks)

Question 7

Express with a rational denominator:

$$\frac{5\sqrt{3}-2}{4+\sqrt{2}} = \frac{5\sqrt{3}-2}{4+\sqrt{2}} \times \frac{4-\sqrt{2}}{4-\sqrt{2}}$$

$$= \frac{(5\sqrt{3}-2)(4-\sqrt{2})}{16-2}$$

$$= \frac{20\sqrt{3} - 5\sqrt{6} - 8 + 2\sqrt{2}}{14}$$

2

EXERCISE 12 – Problem Solving

Write down an algebraic equation to represent each of the problems below, then solve the problem.

SOLUTION

| | |
|--|--|
| 1. Jane drove her car 120km to a town A, then drove on to town B. If she drove a total of 310km, how far is it from town A to town B? <u>The equation is:</u> | |
| 2. If two consecutive numbers add up to 77, what is the smaller of the two numbers? <u>The equation is:</u> | |
| 3. The product of two consecutive numbers is 72. What is the sum of these two numbers? <u>The equation is:</u> | |
| 4. The sum of two consecutive even numbers is 94. What was the smaller number? <u>The equation is:</u> | |
| 5. Fifteen more than half of a certain number is 24. What is the number? <u>The equation is:</u> | |
| 6. The sum of a certain positive number and its square is 90. What is the number? <u>The equation is:</u> | |
| 7. A chair was sold at \$312 after a 20% profit was added to the cost price. What was the original cost price of the chair? <u>The equation is:</u> | |
| 8. If Wendy received twice as much money as Bill and together they received a total of \$135, how much did Bill receive? <u>The equation is:</u> | |
| 9. If I paid 25 cents more for an apple than I paid for a banana, and I paid \$1.35 for both, how much did I pay for the banana? <u>The equation is:</u> | |
| 10. Three people won \$1333. They kept \$208 to buy more tickets and the remainder was shared equally between them. How much did each person receive? <u>The equation is:</u> | |