

1. Identify the radicand of  $\sqrt[6]{4^8}$ .

- a. 8                      b.  $4^8$                       c. 6                      d. 4

2. Simplify  $\left(\frac{36x^4y^3}{4x^8y^{-1}}\right)^{\frac{1}{2}} = (9x^{-4}y^4)^{\frac{1}{2}} = 3x^{-2}y^2 = \frac{3y^2}{x^2}$

- a.  $3x^2y^2$                       b.  $\frac{3y}{x^2}$                       c.  $\frac{3y^2}{x^6}$                       d.  $\frac{3y^2}{x^2}$

3. Which irrational number could be used to represent the hypotenuse of a right triangle with legs 7 cm and 8 cm?

- a.  $\sqrt{15}$  cm                      b.  $\sqrt{113}$  cm                      c.  $\sqrt{30}$  cm                      d.  $\sqrt{56}$  cm

4. Write  $\sqrt{108}$  in simplest form. =  $\sqrt{2 \cdot 54} = \sqrt{2 \cdot 6 \cdot 9} = \sqrt{2 \cdot 2 \cdot 3 \cdot 3 \cdot 3} = 2 \cdot 3 \sqrt{3}$

- a.  $6\sqrt{3}$                       b.  $3\sqrt{6}$                       c.  $3\sqrt{12}$                       d.  $36\sqrt{3}$

5. Write  $7\sqrt{14}$  as an entire radical. =  $\sqrt{7 \cdot 7 \cdot 14} = \sqrt{686}$

- a.  $\sqrt{686}$                       b.  $\sqrt{9604}$                       c.  $\sqrt{1372}$                       d.  $\sqrt{98}$

6. The area of a square is 64 square inches. What do you know about the square?  $\sqrt{64} = 8$

- a. Its side length is irrational and its perimeter is rational.  
 b. Both its side length and its perimeter are irrational.  
 c. Its side length is rational and its perimeter is irrational.  
 d. Both its side length and its perimeter are rational.

7. Write  $2x\sqrt{5x}$  as an entire radical: =  $\sqrt{2x \cdot 2x \cdot 5x} = \sqrt{20x^3}$

- a.  $\sqrt{10x^2}$                       b.  $\sqrt{20x^2}$                       c.  $\sqrt{10x^3}$                       d.  $\sqrt{20x^3}$

8. Write  $\sqrt{\left(\frac{3}{4}\right)^9}$  as a power.  $\left(\frac{3}{4}\right)^{\frac{9}{2}}$

- a.  $\left(\frac{4}{3}\right)^{\frac{2}{9}}$                       b.  $\left(\frac{3}{4}\right)^{\frac{9}{2}}$                       c.  $\left(\frac{3}{4}\right)^{\frac{2}{9}}$                       d.  $\left(\frac{3}{4}\right)^{\frac{9}{2}}$

9. Write  $42^{\frac{5}{4}}$  as a radical.   
 $\frac{5}{4}$  → 5th power  
 → index

- a.  $(\sqrt[4]{42})^5$                       b.  $(\sqrt[5]{42})^4$                       c.  $\sqrt[125]{42}$                       d.  $\sqrt[5]{42^4}$

10. Which of the following lists of numbers contains only irrational numbers?

- a.  $\sqrt{\frac{1}{3}}, \sqrt{25}, \sqrt{2}, \sqrt{15}$                       b.  $\sqrt{5}, \sqrt{\frac{1}{3}}, \sqrt{27}, \sqrt{48}$   
 c.  $\sqrt{\frac{1}{5}}, \sqrt{10}, 0.33, \sqrt{99}$                       d.  $\sqrt{8}, \sqrt{\frac{5}{6}}, \sqrt{21}, \sqrt{63}$

11. The height,  $h$ , in metres, of a Balsam Fir tree can be estimated from the formula  $h = 32d^{\frac{2}{3}}$ , where  $d$  metres is the diameter of the base of the trunk. Use the formula to estimate the approximate height of a tree with a base diameter of 2.4 m.

$$h = 32(2.4)^{\frac{2}{3}}$$

a) about 57.4 metres tall

b) about 61.4 metres tall

use calculator

c) about 119.0 metres tall

d) about 184.3 metres tall

12. Write  $7.5^{1.25}$  as a radical.

$$7.5^{\frac{5}{4}}$$

$$(\sqrt[4]{7.5})^5$$

$$\sqrt[5]{7.5^4}, \text{ or } (\sqrt[5]{7.5})^4$$

$$\sqrt[4]{7.5^{\frac{1}{3}}}, \text{ or } (\sqrt[4]{7.5})^{\frac{1}{3}}$$

b.  $\sqrt[5]{\left(\frac{15}{2}\right)^4}, \text{ or } \left(\sqrt[5]{\frac{15}{2}}\right)^4$

d.  $\sqrt[4]{7.5^5}, \text{ or } (\sqrt[4]{7.5})^5$

13. Simplify  $\frac{(3.5^{-6})(3.5^5)}{3.5^{-1}}$  by writing as a single power.

a.  $3.5^{-2}$

b.  $3.5^0$

c.  $3.5^{-20}$

d.  $3.5^0$

### Constructed Response

1. Write  $\sqrt{1694}$  in simplest form. Show all work.

$$= \sqrt{2 \cdot 7 \cdot 121}$$

$$= \sqrt{2 \cdot 7 \cdot 11 \cdot 11}$$

$$= 11\sqrt{14}$$

2. Write  $8\sqrt{19}$  as an entire radical. Show all work.

$$= \sqrt{8 \cdot 8 \cdot 19}$$

$$= \sqrt{1216}$$

3. Simplify the following:

a)  $\left[ \left( -\frac{x}{y} \right)^{\frac{1}{2}} \right]^4$

$$= \left( -\frac{x}{y} \right)^2$$

$$= -\frac{x^2}{y^2}$$

b)  $\left( \frac{54x^6y}{2x^{-3}y^4} \right)^{\frac{4}{3}}$

$$= (27x^9y^{-3})^{\frac{4}{3}}$$

$$= 27^{\frac{4}{3}} x^{\frac{26}{3}} y^{-\frac{12}{3}}$$

$$= (\sqrt[3]{27})^4 x^{12} y^{-4}$$

$$= 3^4 x^{12} y^{-4}$$

$$= \frac{81x^{12}}{y^4}$$

c)  $(\sqrt[3]{x^2y^4})^2$

$$(x^{\frac{2}{3}}y^{\frac{4}{3}})^{\frac{2}{3}}$$

$$x^{\frac{4}{3}}y^{\frac{8}{3}}$$

d)  $\left( \frac{16y^4}{4x^6y^{-2}} \right)^{\frac{1}{2}}$

$$= \left( \frac{4y^6}{x^6} \right)^{\frac{1}{2}}$$

$$= \frac{2y^3}{x^3}$$

e)  $\frac{1.2^{\frac{1}{3}}}{1.2^{\frac{4}{3}}}$

$$= 1.2^{-\frac{3}{3}}$$

$$= 1.2^{-1}$$

$$= \frac{1}{1.2} = \frac{5}{6}$$

4. Evaluate. No calculators. Show all work.

$$\begin{aligned} \text{a) } (0.25)^{\frac{1}{2}} \\ &= \sqrt{\frac{1}{4}} \\ &= \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \text{b) } \left(\frac{8}{5}\right)^{-3} \\ &= \left(\frac{5}{8}\right)^3 \\ &= \frac{125}{512} \end{aligned}$$

$$\begin{aligned} \text{c) } \left(\frac{125}{8}\right)^{\frac{4}{3}} \\ &= \left(\sqrt[3]{\frac{125}{8}}\right)^4 \\ &= \left(\frac{5}{2}\right)^4 = \frac{625}{16} \end{aligned}$$

$$\begin{aligned} \text{d) } (-27)^{\frac{1}{3}} \\ &= \sqrt[3]{-27} \\ &= -3 \end{aligned}$$

$$\begin{aligned} \text{e) } \left(\frac{4}{25}\right)^{-\frac{1}{2}} &= \left(\frac{25}{4}\right)^{\frac{1}{2}} \\ &= \sqrt{\frac{25}{4}} \\ &= \frac{5}{2} \end{aligned}$$

5. When  $(\sqrt[4]{7^9})(\sqrt[5]{7^3})$  is simplified to  $7^n$ , determine the value of  $n$ .

$$\left(7^{\frac{9}{4}}\right)^{\frac{1}{5}} \left(7^{\frac{3}{5}}\right)^{\frac{1}{4}} = \left(7^{\frac{45}{20}}\right) \left(7^{\frac{12}{20}}\right) = 7^{\frac{57}{20}} \quad n = \frac{57}{20}$$

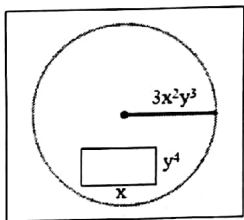
6. Evaluate  $\left(\frac{a^{-\frac{7}{2}} b^{\frac{10}{3}}}{a^{-5} b^4}\right)$  for  $a=4$  and  $b=-8$ .

$$\begin{aligned} &= \frac{a^{-\frac{7}{2}} b^{\frac{10}{3}}}{a^{-\frac{10}{2}} b^{\frac{12}{3}}} = a^{\frac{3}{2}} b^{-\frac{2}{3}} \\ &= (\sqrt{4})^3 \left(\frac{1}{\sqrt[3]{8}}\right)^2 \\ &= (8) \left(\frac{1}{4}\right) = 2 \end{aligned}$$

7. A container is in the shape of a cube with a volume of  $200 \text{ cm}^3$ . What is the side length of this container. Give your answer in simplest radical form.

$$\begin{aligned} V &= 200 \text{ cm}^3 \\ \sqrt[3]{200 \text{ cm}^3} &= \sqrt[3]{2 \cdot 2 \cdot 2 \cdot 25} \text{ cm} \\ &= 2\sqrt[3]{25} \text{ cm} \end{aligned}$$

8. What fraction of the circle's area does the area of the rectangle represent? Write your answer in reduced form.



$$\begin{aligned} \frac{xy^4}{\pi(3x^2y^3)^2} &= \frac{xy^4}{\pi 9x^4y^6} = \frac{x^{-3}y^{-2}}{\pi 9} \\ &= \frac{1}{9\pi x^3 y^2} \end{aligned}$$

9. Without the use of technology, arrange these numbers in order from greatest to least. Show all work.

$$\begin{aligned} &9^{\frac{2}{3}}, \sqrt[3]{9}, 9^{\frac{1}{2}}, \sqrt{9^3}, 9^{12} \\ &\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ &9^{\frac{4}{6}}, 9^{\frac{2}{6}}, 9^{\frac{3}{6}}, 9^{\frac{3}{2}}, 9^{12} \\ &\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow \\ &9^{\frac{4}{6}}, 9^{\frac{2}{6}}, 9^{\frac{3}{6}}, 9^{\frac{9}{6}}, 9^{12} \\ &9^{12}, \sqrt{9^3}, 9^{\frac{2}{3}}, 9^{\frac{1}{2}}, \sqrt[3]{9} \end{aligned}$$

10. Estimate the value of  $\sqrt{35}$  to one decimal place.

$$\sqrt{25} = 5$$

$$\sqrt{36} = 6$$

$$\sqrt{35} \approx 5.9$$

11. Simplify  $\frac{-3a^{-3}b^{-7}c^{-6}}{12a^{-6}b^{-3}c^{-3}}$ . Write using powers with positive exponents.

$$-\frac{1}{4} a^3 b^{-4} c^{-3}$$

$$= \boxed{-\frac{a^3}{4b^4c^3}}$$

12. A cone with equal height and radius has volume  $492 \text{ cm}^3$ . What is the height of the cone to the nearest tenth of a centimetre?

$$V = \frac{1}{3} \pi r^2 h$$

$$492 = \frac{1}{3} \pi r^3$$

$$r = h$$

$$\frac{1476}{\pi} = r^3$$

$$r = 7.7740 \text{ cm}$$

so

$$1476 = \pi r^3$$

$$\sqrt[3]{\frac{1476}{\pi}} = r$$

$$h = 7.8 \text{ cm}$$

13. A tree farmer used the formula  $V = 0.5d^2h$  to estimate the volume,  $V$  cubic metres, of a tree with height  $h$  metres and mean trunk diameter  $d$  metres. The height of a tree is 20 times its mean trunk diameter, and its volume is  $230 \text{ m}^3$ . What is the mean trunk diameter of this tree to the nearest metre?

$$V = 0.5d^2(20d)$$

$$= 10d^3$$

$$\frac{230}{10} = \frac{10d^3}{10}$$

$$h = 20d$$

$$23 = d^3$$

$$\sqrt[3]{23} = d$$

$$\boxed{d = 3 \text{ m}}$$

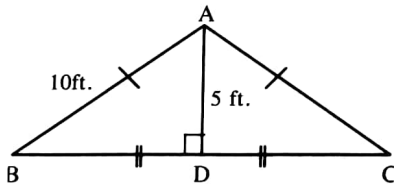
14. Determine whether the perimeter of a square with area  $28 \text{ m}^2$  is a rational number or an irrational number.

$$S = \sqrt{28 \text{ m}^2}$$

$$P = 4s$$

$$P = 4\sqrt{28 \text{ m}^2} \rightarrow \text{Irrational}$$

15. In isosceles  $\triangle ABC$ , what is the length of  $BC$ ? Write your answer as a mixed radical.



$$a^2 + b^2 = c^2$$

$$c^2 - b^2 = a^2$$

$$(10 \text{ ft})^2 - (5 \text{ ft})^2 = a^2$$

$$100 - 25 = a^2$$

$$a = \sqrt{75}$$

$$BC = 2a$$

$$= 2\sqrt{75}$$

$$= 2\sqrt{3 \cdot 25}$$

$$= 2\sqrt{3 \cdot 5 \cdot 5}$$

$$\boxed{= 10\sqrt{3} \text{ ft}}$$

16. Use exponent laws to simplify  $(\sqrt[8]{x})(\sqrt[5]{x^3})$ . Explain your strategy.

change to powers

$$\left(x^{\frac{1}{8}}\right)\left(x^{\frac{3}{5}}\right) \xrightarrow{\text{Add exp}} \left(x^{\frac{5}{40}}\right)\left(x^{\frac{24}{40}}\right)$$

$$x^{\frac{29}{40}}$$