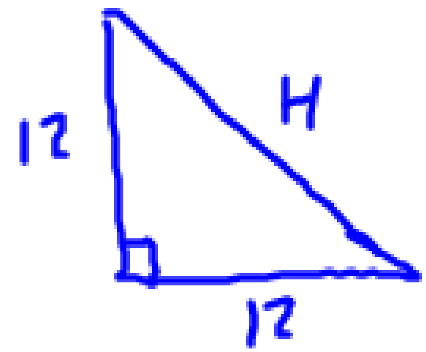
Apply

11. The air pressure, p, in millibars (mbar) at the centre of a hurricane, and wind speed, w, in metres per second, of the hurricane are related by the formula $w = 6.3\sqrt{1013 - p}$. What is the exact wind speed of a hurricane if the air pressure is 965 mbar?

$$w = 6.3\sqrt{1013 - 965}$$
$$= 6.3\sqrt{48}$$
$$= 6.3\sqrt{16}\sqrt{3}$$
$$= 6.3 \cdot 4\sqrt{3}$$
$$= 25.2\sqrt{3} \text{ m/s}$$

12. Saskatoon artist Jonathan Forrest's painting, *Clincher*, contains geometric shapes. The isosceles right triangle at the top right has legs that measure approximately 12 cm. What is the length of the hypotenuse? Express your answer as a radical in simplest form.



$$H^2 = 12^2 + 12^2$$
$$H^2 = 288$$
$$H = \sqrt{288}$$
$$H = \sqrt{144}\sqrt{2}$$
$$H = 12\sqrt{2} \text{ cm}$$

13. The distance, d, in millions of kilometres, between a planet and the Sun is a function of the length, n, in Earth-days, of the planet's year. The formula is $d = \sqrt[3]{25n^2}$. The length of 1 year on Mercury is 88 Earth-days, and the length of 1 year on Mars is 704 Earth-days. Use the subtraction of radicals to determine the difference between the distances of Mercury and Mars from the Sun. Express your answer in exact form.

Planet Venus

Mercury

$\sqrt[3]{25\cdot 88^2}$

$\sqrt[3]{193600}$

$\sqrt[3]{8}\ \sqrt[3]{8}\ \sqrt[3]{3025}$

$2\cdot 2\ \sqrt[3]{3025}$

$4\sqrt[3]{3025}$

Mars

$\sqrt[3]{25\cdot 704^2}$

$\sqrt[3]{12390400}$

$\sqrt[3]{8}\ \sqrt[3]{8}\ \sqrt[3]{8}\ \sqrt[3]{8}\ \sqrt[3]{3025}$

$2\cdot 2\cdot 2\cdot 2\ \sqrt[3]{3025}$

$16\sqrt[3]{3025}$

*difference $12\sqrt[3]{3025}$ million km

14. The speed, s, in metres per second, of a tsunami is related to the depth, d, in metres, of the water through which it travels. This relationship can be modelled with the formula $s = \sqrt{10d}$, $d \geq 0$. A tsunami has a depth of 12 m. What is the speed as a mixed radical and an approximation to the nearest metre per second?

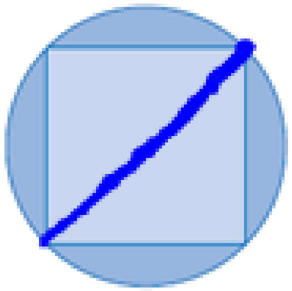
$s = \sqrt{10(12)}$

$s = \sqrt{120}$

$s = \sqrt{4}\sqrt{30}$

$s = 2\sqrt{30}$ m/s

15. A square is inscribed in a circle. The area of the circle is 38π m^2.



$A_{circle} = 38\pi$ m^2

a) What is the exact length of the diagonal of the square?

b) Determine the exact perimeter of the square.

a) circle this circle

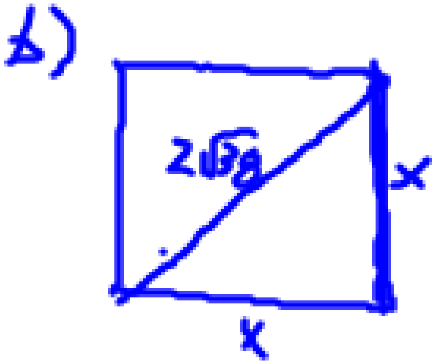
$\pi r^2 = 38\pi$

$r^2 = 38$

$r = \sqrt{38}$

$d = 2\sqrt{38}$ m

b)



$x^2 + x^2 = (2\sqrt{38})^2$

$2x^2 = 4(38)$

$x^2 = 76$

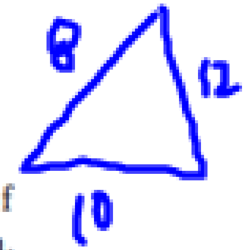
$x = \sqrt{76}$

$\sqrt{4}\sqrt{19}$

$x = 2\sqrt{19}$

perim $= 8\sqrt{19}$ m

16. You can use Heron's formula to determine the area of a triangle given all three side lengths. The formula is $A = \sqrt{s(s-a)(s-b)(s-c)}$, where s represents the half-perimeter of the triangle and a, b, and c are the three side lengths. What is the exact area of a triangle with sides of 8 mm, 10 mm, and 12 mm? Express your answer as an entire radical and as a mixed radical.



perim $= 8 + 10 + 12 = 30$

$s = \frac{1}{2}$ perim $= 15$

$A = \sqrt{15(15-8)(15-10)(15-12)}$

$A = \sqrt{15(7)(5)(3)}$

$A = \sqrt{1575}$

$A = \sqrt{25}\sqrt{63}$

$A = \sqrt{25}\sqrt{9}\sqrt{7}$

$= 5 \cdot 3\sqrt{7}$

$A = 15\sqrt{7}$ mm^2

17. Suppose an ant travels in a straight line across the Cartesian plane from (3, 4) to (6, 10). Then, it travels in a straight line from (6, 10) to (10, 18). How far does the ant travel? Express your answer in exact form.

d (6,10) 6 (3,4) 3

$d^2 = 3^2 + 6^2$

$d^2 = 45$

$d = \sqrt{45}$

$d = \sqrt{9}\sqrt{5}$

$d = 3\sqrt{5}$

d (10,18) 8 (6,10) 4

$d^2 = 4^2 + 8^2$

$d^2 = 80$

$d\ \sqrt{16}\sqrt{5} = 4\sqrt{5}$

total $7\sqrt{5}$

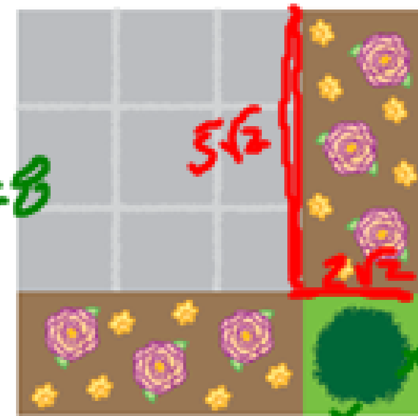
18. Leslie's backyard is in the shape of a square. The area of her entire backyard is 98 m². The green square, which contains a tree, has an area of 8 m². What is the exact perimeter of one of the rectangular flowerbeds?

$side^2 = 98$

$side = \sqrt{98}$

$\sqrt{49}\sqrt{2}$

$7\sqrt{2}$



greensquare=8

$side = \sqrt{8}$

$= \sqrt{4}\sqrt{2}$

$= 2\sqrt{2}$

perimeter

$5\sqrt{2} + 2\sqrt{2} + 5\sqrt{2} + 2\sqrt{2}$

$14\sqrt{2}$ m

19. Kristen shows her solution to a radical problem below. Brady says that Kristen's final radical is not in simplest form. Is he correct? Explain your reasoning.

Kristen's Solution

$$y\sqrt{4y^3} + \sqrt{64y^5} = y\sqrt{4y^3} + 4y\sqrt{4y^3}$$
$$= 5y\sqrt{4y^3}$$

↑ good so far

$$= 5y\sqrt{4y^2}\sqrt{y}$$
$$= 5y \cdot 2y\sqrt{y}$$
$$= 10y^2\sqrt{y}$$

20. Which expression is not equivalent to $12\sqrt{6}$?

$2\sqrt{216}$, $3\sqrt{96}$, $4\sqrt{58}$, $6\sqrt{24}$

Explain how you know without using technology.

$2\sqrt{216}$
$2\sqrt{36}\sqrt{6}$
$2 \cdot 6\sqrt{6}$
$12\sqrt{6}$ ✓

$3\sqrt{96}$
$3\sqrt{16}\sqrt{6}$
$3 \cdot 4\sqrt{6}$
$12\sqrt{6}$ ✓

$4\sqrt{58}$ simplified

not equal to $12\sqrt{6}$

$6\sqrt{24}$
$6\sqrt{4}\sqrt{6}$
$6 \cdot 2\sqrt{6}$
$12\sqrt{6}$ ✓

5.2 Multiplying + Dividing Radicals

① Multiplying

a) $\sqrt{3} \cdot \sqrt{5} = \sqrt{15}$

$\sqrt{2} \cdot \sqrt{10} = \sqrt{20}$

$\sqrt{4}\sqrt{5}$

$2\sqrt{5}$

b) $\sqrt[3]{7} \cdot \sqrt[3]{10} = \sqrt[3]{70}$

c) $5\sqrt{3} \cdot \sqrt{6} = 5\sqrt{18} = 5\sqrt{9}\sqrt{2}$

$5 \cdot 3\sqrt{2}$

$15\sqrt{2}$

8

27

64

d) $-2\sqrt[3]{11}\left(4\sqrt[3]{2} - 3\sqrt[3]{3}\right)$

$-8\sqrt[3]{22} + 6\sqrt[3]{33}$

$5x \cdot y$

$5xy$

e) $(4\sqrt{2}+3)(7-5\sqrt{14})$

FOIL

$28\sqrt{2}-20\sqrt{28}+21-15\sqrt{14}$

$28\sqrt{2}-20\sqrt{4}\sqrt{7}+21-15\sqrt{14}$

$28\sqrt{2}-40\sqrt{7}+21-15\sqrt{14}$

f) $(3+\sqrt{2})(3+\sqrt{2})$

$9+3\sqrt{2}+3\sqrt{2}+2$

$11+6\sqrt{2}$

f) $(3+\sqrt{2})^2$

$9+2+2\cdot 3\sqrt{2}$

$11+6\sqrt{2}$

$(a+b)^2$

a^2+b^2+2ab

$(x+3)^2$

x^2+9+6x

x^2+6x+9

② Dividing

a) $\frac{\sqrt{10}}{\sqrt{2}}$

$\sqrt{5}$

b) $\frac{10\sqrt{20}}{5\sqrt{2}}$

$2\sqrt{10}$

c) $\frac{4\sqrt[3]{6}}{2\sqrt[3]{3}}$

$2\sqrt[3]{2}$

d) $\frac{25\sqrt{6}}{10\sqrt{18}} = \frac{25\sqrt{6}}{10\sqrt{9}\sqrt{2}} = \frac{25\sqrt{6}}{10 \cdot 3\sqrt{2}} = \frac{25\sqrt{6}}{30\sqrt{2}}$

$= \frac{5}{6}\sqrt{3}$ ✓

$= \frac{5\sqrt{3}}{6}$ ✓

$\frac{5}{2\sqrt{3}}$

no radicals in denominator!

③ Rationalize Denominator

a) $\frac{1}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right) = \frac{\sqrt{3}}{3}$

b) $\frac{2}{\sqrt{5}}\left(\frac{\sqrt{5}}{\sqrt{5}}\right) = \frac{2\sqrt{5}}{5}$

c) $\frac{7}{\sqrt{7}}\left(\frac{\sqrt{7}}{\sqrt{7}}\right) = \frac{\cancel{7}\sqrt{7}}{\cancel{7}}$

$= \sqrt{7}$

* d) $\frac{5}{1+\sqrt{2}}$ conjugate the denominator.

$(a+b)$ conjugate $(a-b)$

$$\frac{5}{1+\sqrt{2}} \cdot \frac{1-\sqrt{2}}{1-\sqrt{2}} = \frac{5-5\sqrt{2}}{1-2}$$

$$= \frac{5-5\sqrt{2}}{-1}$$

$$= -5+5\sqrt{2}$$

e) $\frac{11}{\sqrt{5}-7}\left(\frac{\sqrt{5}+7}{\sqrt{5}+7}\right) = \frac{11\sqrt{5}+77}{5-49}$

$= \frac{11\sqrt{5}+77}{-44}$

$\frac{\sqrt{5}+7}{-4}$ OR $\frac{-\sqrt{5}-7}{4}$

* 1-10 pgs 289-290