Inverses in Context

The population of a town can be modeled by

$P = 16{,}500t^{0.15}$

where t = # years after 1998

Re-write the equation in terms of t.

$\frac{P}{16500} = \frac{16500t^{0.15}}{16500}$

$\left(\frac{P}{16500}\right)^{\frac{1}{0.15}} = \left(t^{0.15}\right)^{\frac{1}{0.15}}$

$\left(\frac{P}{16500}\right)^{6.67} = t$

BOAT SPEED The maximum hull speed v (in knots) of a boat with a displacement hull can be approximated by

$$v = 1.34\sqrt{\ell}$$

where ℓ is the length (in feet) of the boat's waterline. Find the inverse of the model. Then find the waterline length needed to achieve a maximum speed of 7.5 knots.

$\frac{V}{1.34} = \frac{1.34\sqrt{\ell}}{1.34}$

$\left(\frac{V}{1.34}\right)^2 = \left(\sqrt{\ell}\right)^2$

$\ell = \left(\frac{V}{1.34}\right)^2$

$V = 7.5$ $\quad \ell = \left(\frac{7.5}{1.34}\right)^2 = 31.3$ ft.

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50. BIOLOGY The body surface area A (in square meters) of a person with a mass of 60 kilograms can be approximated by the model

$$A = 0.2195h^{0.3964}$$

where h is the person's height (in centimeters). Find the inverse of the model. Then estimate the height of a 60 kilogram person who has a body surface area of 1.6 square meters.

$\frac{A}{0.2195} = \frac{0.2195h^{0.3964}}{0.2195}$

$\left(\frac{A}{0.2195}\right)^{\frac{1}{0.3964}} = \left(h^{0.3964}\right)^{\frac{1}{0.3964}}$

$\left(\frac{A}{0.2195}\right)^{2.52} = h$

$A = 1.6$ $\quad h = \left(\frac{1.6}{0.2195}\right)^{2.52}$

$h = 149$ cm