

PROBLEM SOLVING

EXAMPLE 2

on p. 421
for Exs. 83–84

- 83. BIOLOGY** Look back at Example 2 on page 421. Use the model $S = km^{2/3}$ to approximate the surface area of the mammal given its mass.
- Bat: 32 grams
 - Human: 59 kilograms

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- 84. AIRPLANE VELOCITY** The velocity v (in feet per second) of a jet can be approximated by the model

$$v = 8.8\sqrt{\frac{L}{A}}$$

where A is the area of the wings (in square feet) and L is the lift (in Newtons). Find the velocity of a jet with a wing area of 5.5×10^3 square feet and a lift of 1.4×10^7 Newtons.

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- 85. PINHOLE CAMERA** The optimum diameter d (in millimeters) of the pinhole in a pinhole camera can be modeled by

$$d = 1.9[(5.5 \times 10^{-4})\ell]^{1/2}$$

where ℓ is the length of the camera box (in millimeters). Find the optimum pinhole diameter for a camera box with a length of 10 centimeters.

- 86. ★ STARSTRENGTH** Show that the hypotenuse of an isosceles right triangle with legs of length x is $x\sqrt{2}$.
- 87. STAR MAGNITUDE** The *apparent magnitude* of a star is a number that indicates how faint the star is in relation to other stars. The expression $\frac{2.512^{m_1}}{2.512^{m_2}}$ tells how many times fainter a star with magnitude m_1 is than a star with magnitude m_2 .
- How many times fainter is Altair than Vega?
 - How many times fainter is Deneb than Altair?
 - How many times fainter is Deneb than Vega?

Star	Apparent magnitude	Constellation
Vega	0.03	Lyra
Altair	0.77	Aquila
Deneb	1.25	Cygnus



- 88. PHYSICAL SCIENCE** The maximum horizontal distance d that an object can travel when launched at an optimum angle of projection is given by

$$d = \frac{v_0\sqrt{(v_0)^2 + 2gh_0}}{g}$$

where h_0 is the object's initial height, v_0 is its initial speed, and g is the acceleration due to gravity. Simplify the model when $h_0 = 0$.

