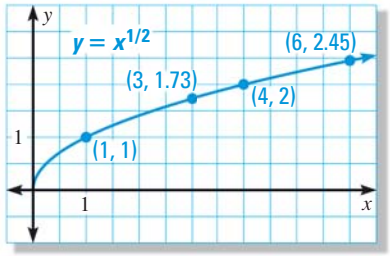
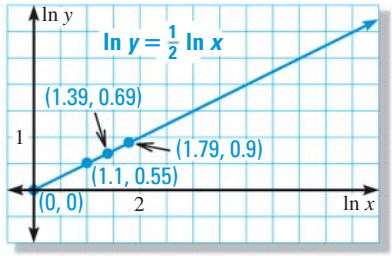
TRANSFORMING POWER DATA A set of more than two points (x, y) fits a power pattern if and only if the set of transformed points $(\ln x, \ln y)$ fits a linear pattern.

Graph of points (x, y)



The graph is a power curve.

Graph of points $(\ln x, \ln y)$



The graph is a line.

EXAMPLE 5 Find a power model

BIOLOGY The table at the right shows the typical wingspans x (in feet) and the typical weights y (in pounds) for several types of birds.

- Draw a scatter plot of the data pairs $(\ln x, \ln y)$. Is a power model a good fit for the original data pairs (x, y)?
- Find a power model for the original data.

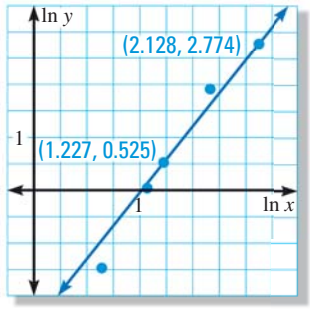
Bird	Wingspan (ft), x	Weight (lb), y
Cuckoo	1.90	0.23
Crow	2.92	1.04
Curlew	3.41	1.69
Goose	5.35	6.76
Vulture	8.40	16.03

Solution

STEP 1 **Use** a calculator to create a table of data pairs $(\ln x, \ln y)$.

$\ln x$	0.642	1.072	1.227	1.677	2.128
$\ln y$	−1.470	0.039	0.525	1.911	2.774

STEP 2 **Plot** the new points as shown. The points lie close to a line, so a power model should be a good fit for the original data.



STEP 3 **Find** a power model $y = ax^b$ by choosing two points on the line, such as (1.227, 0.525) and (2.128, 2.774). Use these points to write an equation of the line. Then solve for y.

$\ln y - y_1 = m(\ln x - x_1)$ — Equation when axes are ln x and ln y

$\ln y - 2.774 = 2.5(\ln x - 2.128)$ — Substitute.

$\ln y = 2.5 \ln x - 2.546$ — Simplify.

$\ln y = \ln x^{2.5} - 2.546$ — Power property of logarithms

$y = e^{\ln x^{2.5} - 2.546}$ — Exponentiate each side using base e.

$y = e^{-2.546} \cdot e^{\ln x^{2.5}}$ — Product of powers property

$y = 0.0784x^{2.5}$ — Simplify.

USE POINT-SLOPE FORM

The slope of the line is $\frac{2.774 - 0.525}{2.128 - 1.227} \approx 2.50$.