Lesson 12.2.1

12-18. a. $y = -8.16 + 0.99x$

b. $r = 0.9734$. 97.34% of the variability in weight of metal can be explained by a linear relationship with lid diameter.

c. The curved pattern in the residual plot indicates that a linear model is not appropriate for this data.

12-19. a. Since the area = πr^2, the weight should be related to the square of the radius.

b. Take the square root of both sides (assuming $y \geq 0$ always!) will give $\sqrt{y} = a + bx$, a linear relationship between x and $\sqrt{y}$.

c. Regression equation: $\sqrt{y} = 0.65 + 0.13x$, $r = 0.999$, $R^2 = 0.999$

d. The residual plot is still curved! R and R^2 are better, which could be a good sign, but it is still not a great model because the residual plot still shows the curve.

12-20. a. y and x^2

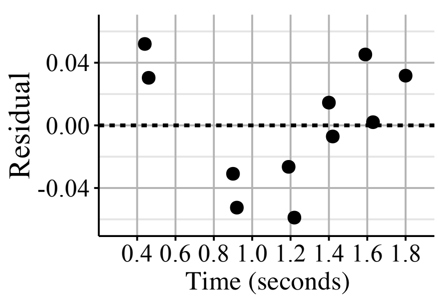
b. $r = 1$, $R^2 = 1$. Equation: $y = 2.00 + 0.02x^2$. This model is definitely superior—the r and r^2 values round to a perfect 1, and the residual plot shows no clear pattern.

c. $y = 2.00 + 0.02(32)^2 = 22.48$ lbs

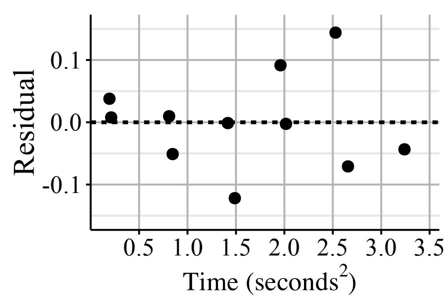
12-21. Run two models: a linear model of y vs. x^k and another linear model of $\sqrt[k]{y}$ vs. x. Compare the R^2 and residual plots of the models and decide which is the best one.

12-22. See graphs below. The $\hat{y} = a + bx^2$ model has no discernable pattern in its residual plot and $r = 0.999$. For a coin falling 5 seconds: $\hat{y} = 0.6393 + 1.6680(5^2)$. $\hat{y} = 42.34 \approx$ the 42nd floor

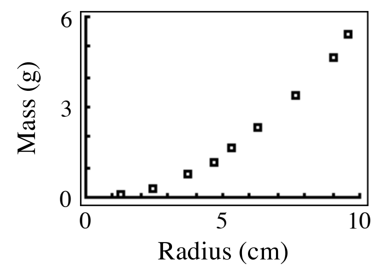
$\sqrt{\hat{y}} = a + bx$



$\hat{y} = a + bx^2$



12-23. a. See graph at right. Mass is very strongly positively associated with radius in a nonlinear manner with no apparent outliers.



b. A good model is representative of the physical situation. A quadratic regression (or a power regression with an exponent of ≈ 2) makes a good model since mass is a function of πr^2.

c. There are several reasonable choices for transformation: you could take the square root of the masses, square the radii, or take logs of both parts. Possible equations are $m = -0.0264 + 0.0580r^2$, $\sqrt{m} = -0.0152 + 0.2417r$. These are all very similar, and all model the equation very well based on residual plots and R^2 values.

d. About 2.8 g.

12-24. a. The slope is –628.

b. The null hypothesis is that the slope is 0.

c. It is not a horizontal line. There is some nonzero predicted change in y when x increases by one unit.

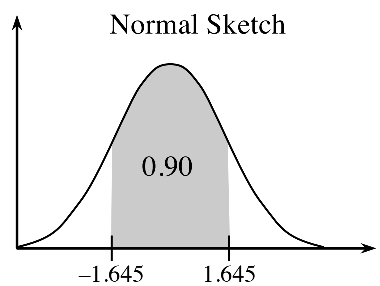
12-25. a. geometpdf(0.63, 7) or $(0.37)^6 \cdot 0.63 = 0.0016$

b. $\frac{1}{0.63} \approx 1.58$

c. Binomial distribution, let X = shots made, W = Steve's winnings, $E(W)$ = \$4.66. Steve should take the bet. See table below.

	X					
	0	1	2	3	4	5
$P(X)$	0.0069	0.0590	0.2010	0.3423	0.2914	0.0992
W	– \$10	– \$10	– \$10	\$10	\$10	\$10

12-26. Identify: one sample proportion interval.
Check conditions: Random selection—"randomly" was mentioned in the problem description with regards to sampling technique. Sample with replacement or large population—it must be assumed that the population of interest is larger than ten times the sample size of 698. Large counts—$np = 652$, and $n(1-p) = 46$, which are both at least 10.



Calculate: See diagram above right. $SE = \sqrt{\frac{0.9341(1-0.9341)}{698}} = 0.0094$,
z* = invnorm(0.950, 0, 1) = 1.645, CI = $p \pm$ (z*)(SE),
CI = 0.934 ± (1.645)(0.0094) = $(0.9186 < p < 0.9495)$.
Conclude: Mitesh should reject Kacey's claim that $p < 0.91$. Because 0.91 is entirely below the confidence interval, it is very unlikely that $p < 0.91$.

