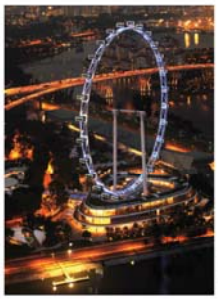
3.5 Regressions

$Y = 246\sin(.17x - 1.57) + 295$

In 2011, the Singapore Flyer was the largest Ferris wheel in the world. The table below gives the height of a rider from the ground at different times.

Time (min)	Height (ft)
0	49
9.25	295
18.50	541
27.75	295
37.00	49
46.25	295
55.50	541
64.75	295
74.00	49



The Singapore Flyer, built on land reclaimed from the sea, first turned in 2008.

Jordy got on the Singapore Flyer at noon and rode it for four consecutive rotations. His friend Yale was in a building directly across from the Singapore Flyer, at a height of 400 ft. When was Jordy level with Yale?

Y

How high was he after 32 min?

X

Y = 132m

12min, 25min

49min, 62min

86min, 99min

123min, 136min

Max: d+a = 541m

Min: d-a = 49m

Y-int: starting height

Apr 20-10:47 AM

APPLY the Math

EXAMPLE 1 Solving an interpolation problem using a sinusoidal model

Celeste lives in Red Deer, Alberta. The predicted hours of daylight for two consecutive years are shown in the tables below. In the second year, the spring equinox will occur on March 20 and the fall equinox will occur on September 23. Compare the hours of daylight on these two days.

N Y

Hours of Daylight in Red Deer This Year		
Date	Day Number	Length of Day (h)
Jan. 1	1	7.812
Feb. 1	32	9.113
Mar. 1	60	10.896
Apr. 1	91	12.998
May 1	121	14.944
Jun. 1	152	16.455
Jul. 1	182	16.690
Aug. 1	213	15.494
Sep. 1	244	13.595
Oct. 1	274	11.597
Nov. 1	305	9.580
Dec. 1	335	8.064

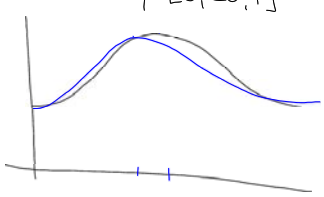
Predicted Hours of Daylight in Red Deer Next Year		
Date	Day Number	Length of Day (h)
Jan. 1	366	7.808
Feb. 1	397	9.100
Mar. 1	425	10.880
Apr. 1	456	12.982
May 1	486	14.929
Jun. 1	517	16.447
Jul. 1	547	16.694
Aug. 1	578	15.507
Sep. 1	609	13.611
Oct. 1	639	11.613
Nov. 1	670	9.595
Dec. 1	700	8.073
Jan. 1	731	7.803

$Y_1 = 4.44\sin(0.02x - 1.35) + 12.14$

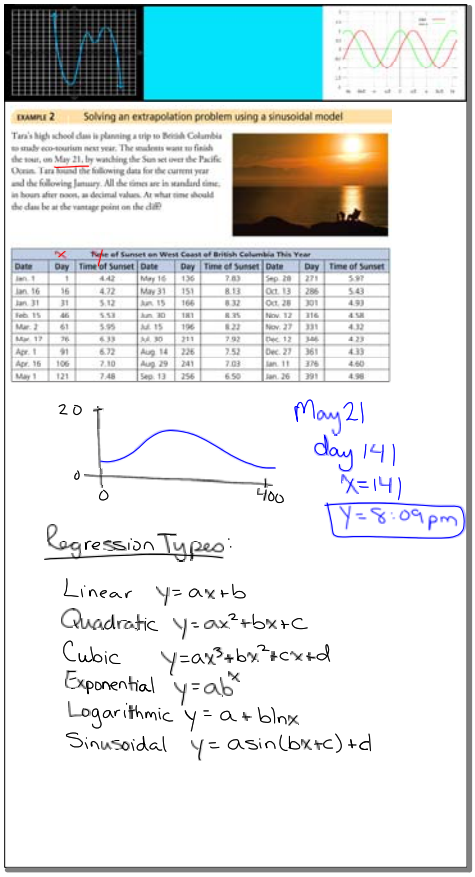
$Y_2 = 4.42\sin(0.021x - 1.17) + 12.17$

X: [0, 385, 1]

Y: [0, 20, 1]



Apr 20-1:52 PM



EXAMPLE 2 Solving an extrapolation problem using a sinusoidal model

Tara's high school class is planning a trip to British Columbia to study eco-tourism next year. The students want to finish the tour, on May 21, by watching the Sun set over the Pacific Ocean. Tara found the following data for the current year and the following January. All the times are in standard time, in hours after noon, as decimal values. At what time should the class be at the vantage point on the cliff?

Table of Sunset on West Coast of British Columbia This Year

Date	Day	Time of Sunset	Date	Day	Time of Sunset	Date	Day	Time of Sunset
Jan. 1	1	4.42	May 16	136	7.83	Sep. 28	271	5.97
Jan. 16	16	4.72	May 31	151	8.13	Oct. 13	286	5.43
Jan. 31	31	5.12	Jun. 15	166	8.32	Oct. 28	301	4.93
Feb. 15	46	5.53	Jun. 30	181	8.35	Nov. 12	316	4.58
Mar. 2	61	5.95	Jul. 15	196	8.22	Nov. 27	331	4.32
Mar. 17	76	6.33	Jul. 30	211	7.92	Dec. 12	346	4.23
Apr. 1	91	6.72	Aug. 14	226	7.52	Dec. 27	361	4.33
Apr. 16	106	7.10	Aug. 29	241	7.03	Jan. 11	376	4.60
May 1	121	7.48	Sep. 13	256	6.50	Jan. 26	391	4.98

May 21
day 141
$x = 141$
$y = 8:09\text{pm}$

Regression Types:

Linear $y = ax + b$
Quadratic $y = ax^2 + bx + c$
Cubic $y = ax^3 + bx^2 + cx + d$
Exponential $y = ab^x$
Logarithmic $y = a + b\ln x$
Sinusoidal $y = a\sin(bx + c) + d$

Apr 20-1:53 PM