What's Going On?

Checking In Test Thursday

Minds on Motor Vehicle Accidents 1

Action! The Importance of Past and Future Behaviour

Consolidation Motor Vehicle Accidents 2

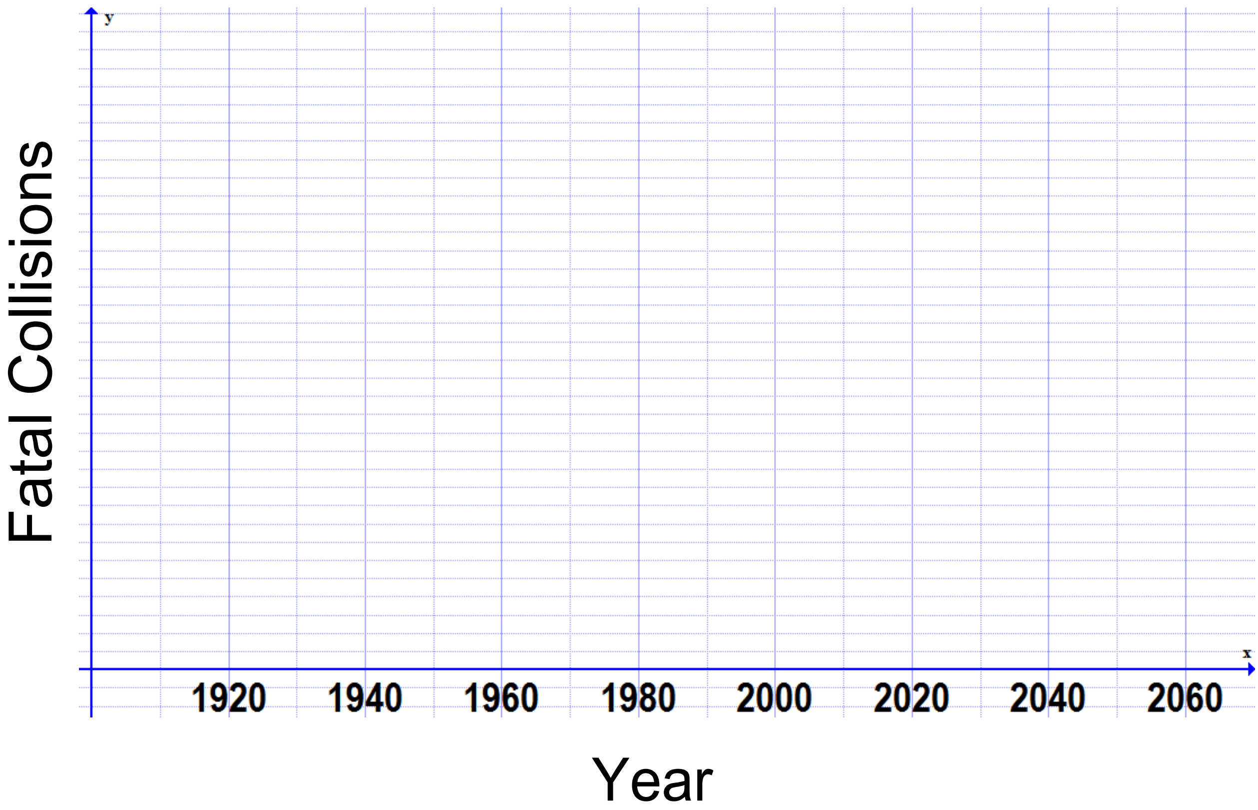
Learning Goal - I will be able to use past and future behaviour to choose reasonable mathematical models.

Minds on

Motor Vehicle Accidents:
The Common Sense Approach

Please get a whiteboard, a marker and an eraser.

Draw a **rough** graph of your prediction of the relationship between year and the number of fatal motor vehicle accidents between 1900 and 2060.



Minds on

Motor Vehicle Accidents: The Common Sense Approach

What factors would affect the number of fatal collisions over time?

- population
- rules of road
- technology
- speed
- education
- distraction
- road conditions
- laws

Action!

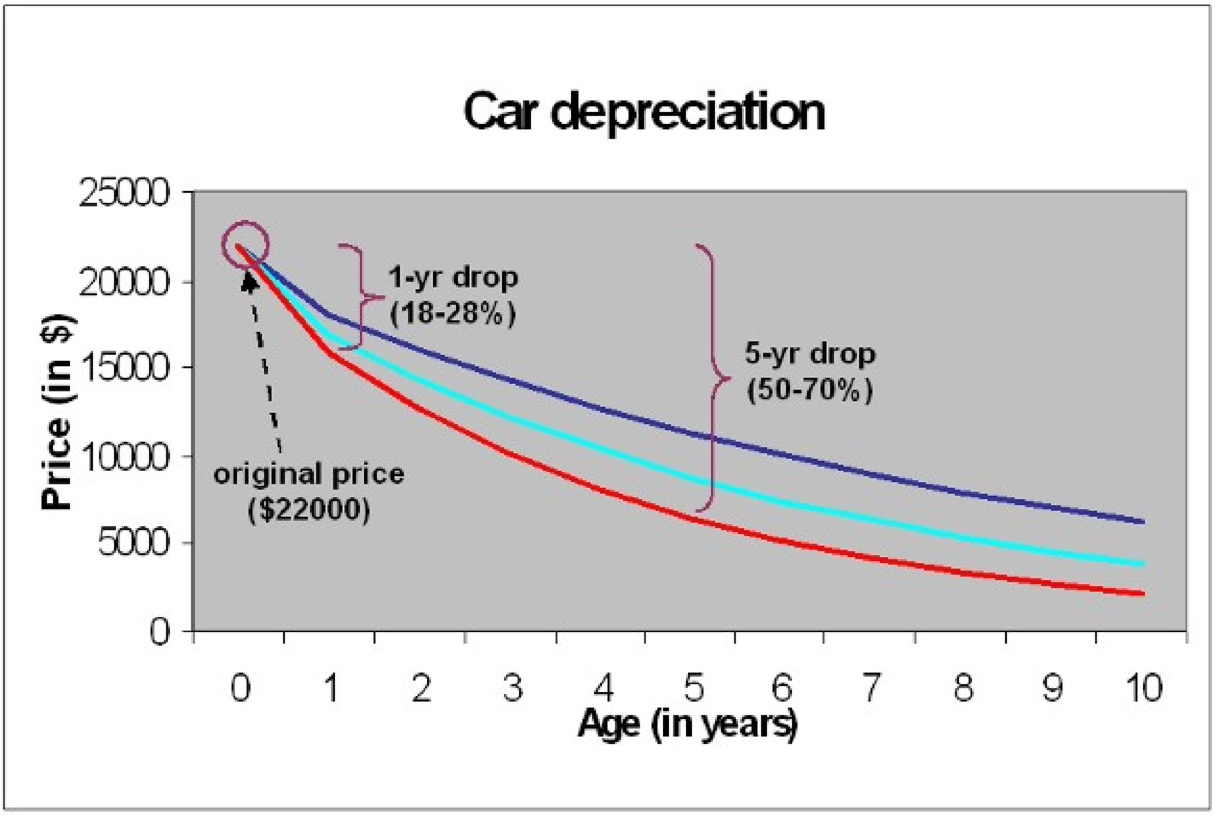
The Importance of Past and Future Behaviour

As we've seen, more than one model can often do a good job at fitting a set of data.

Therefore, past and future behaviour can give important clues as to which model is more suitable.

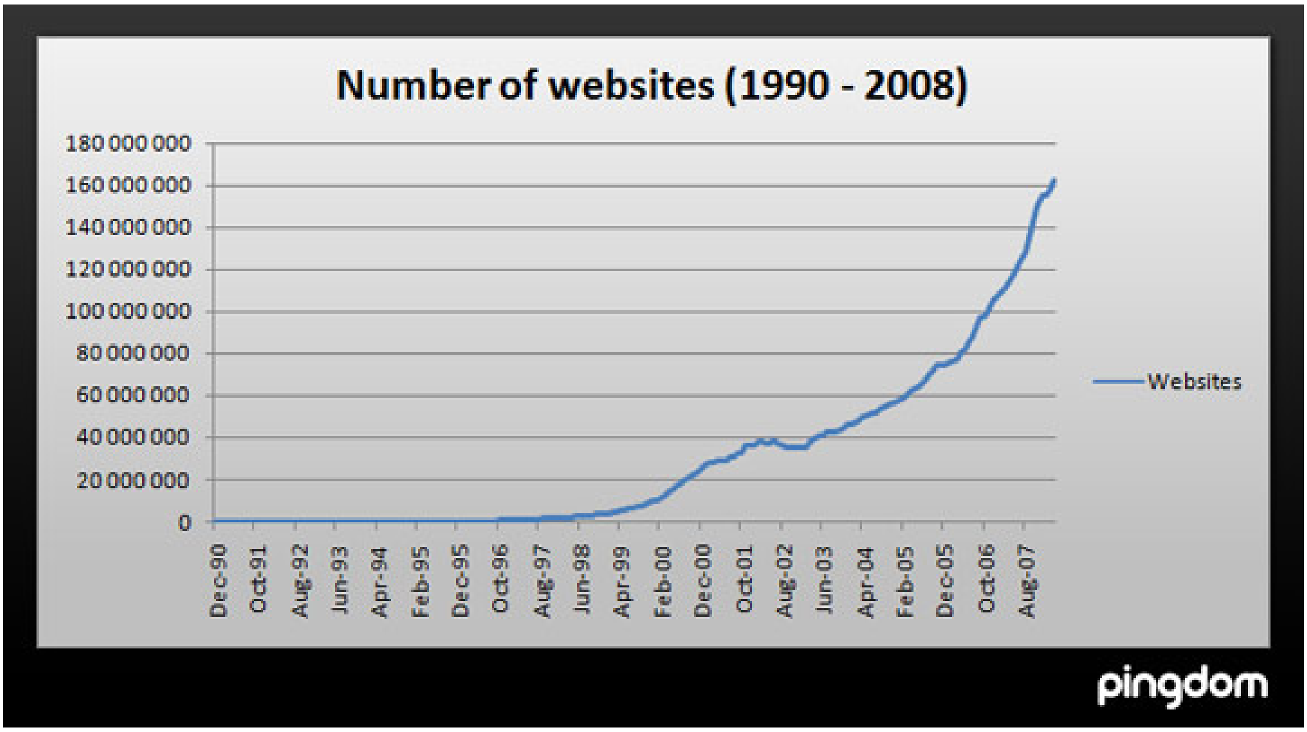
Action!

The Importance of Past and Future Behaviour



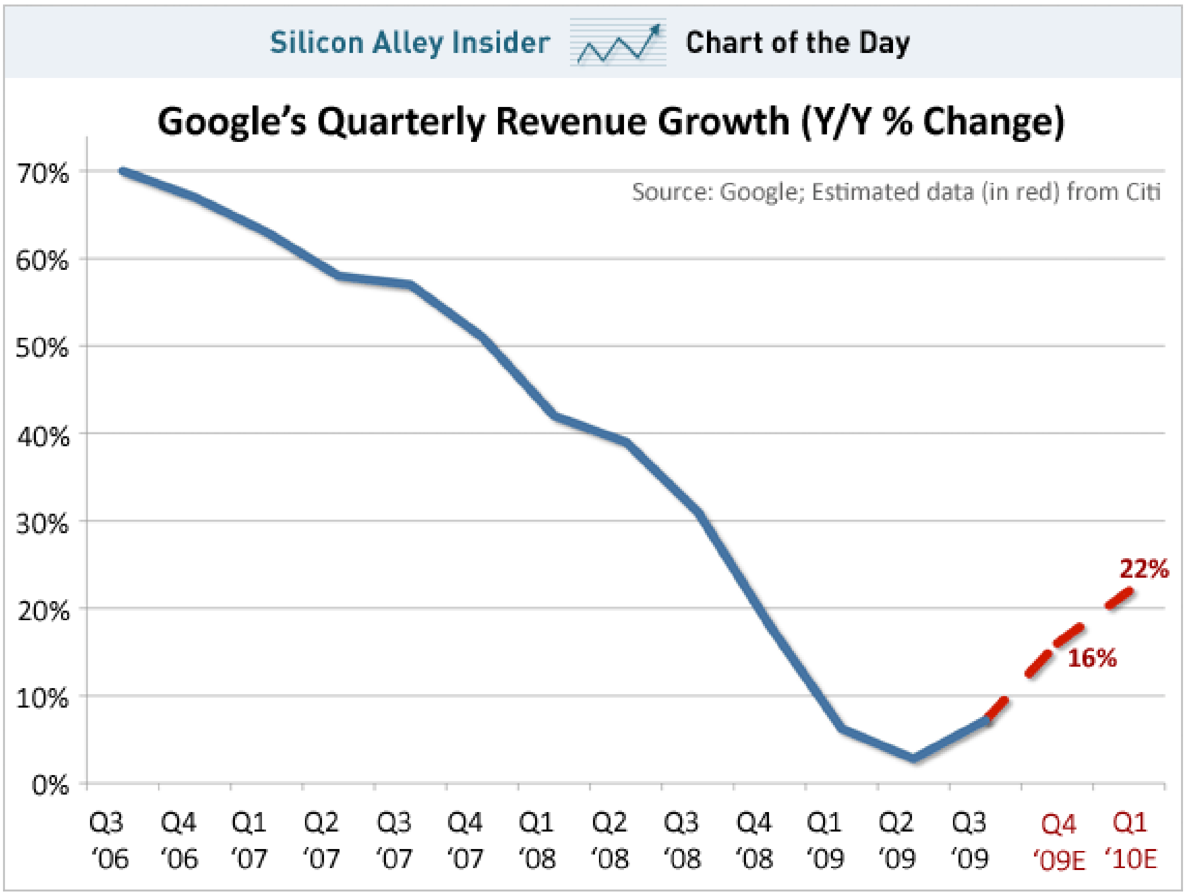
Action!

The Importance of Past and Future Behaviour



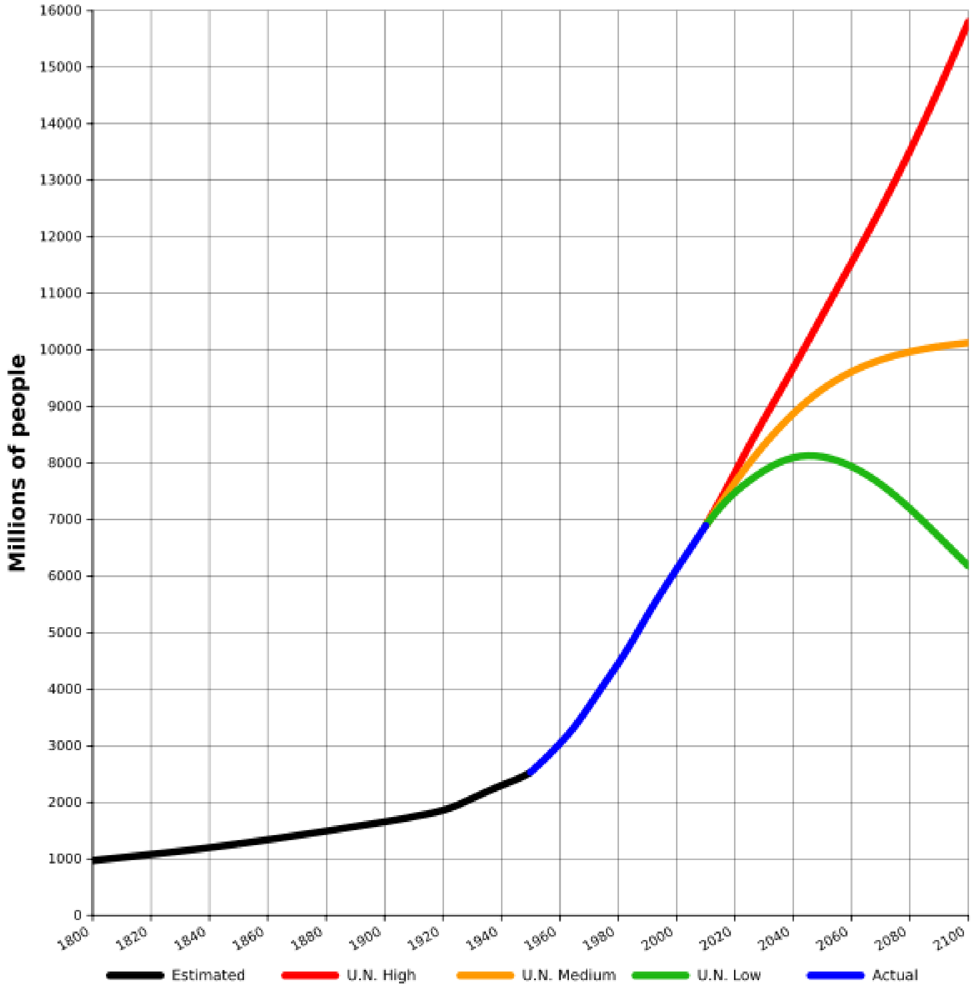
Action!

The Importance of Past and Future Behaviour



Action!

The Importance of Past and Future Behaviour



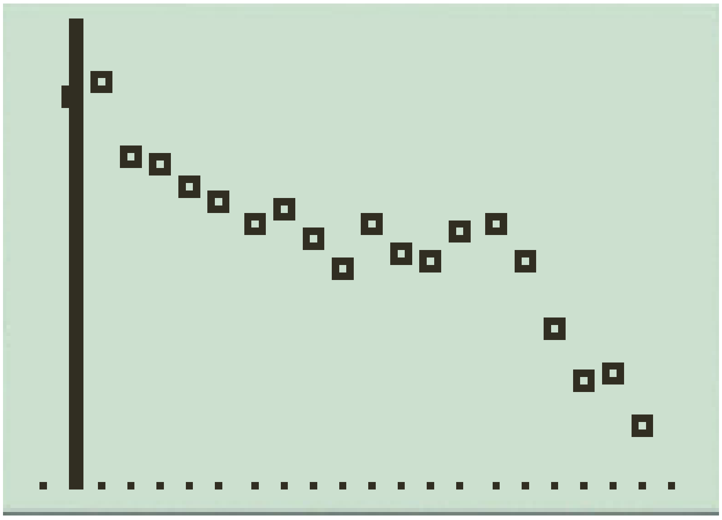
The previous slides were used as examples of when knowing or not knowing past and future behaviour could result in very different choices of appropriate mathematical models (linear vs. quadratic vs. exponential).

Consolidation

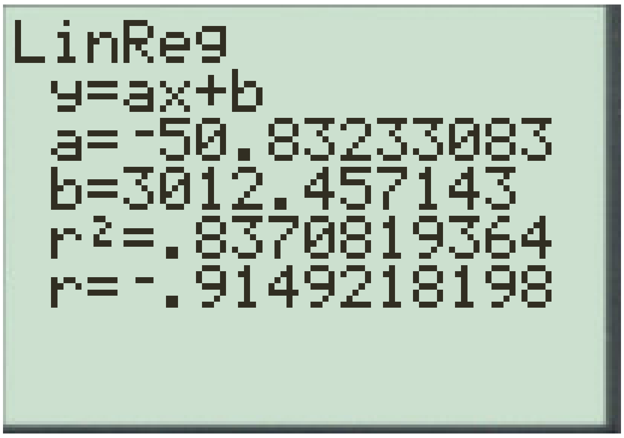
Motor Vehicle Accidents: The Analytical Approach

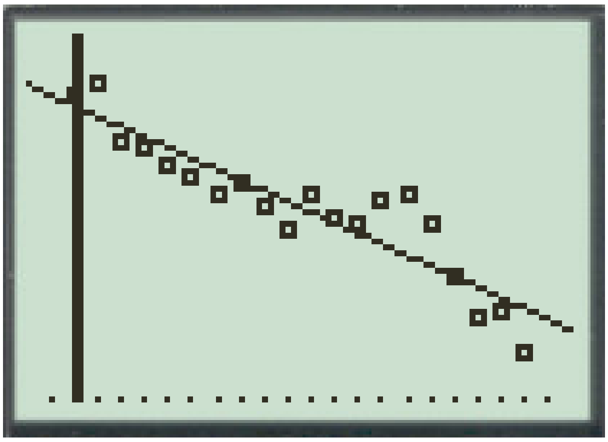
COLLISIONS AND CASUALTIES 1992-2011

YEAR	COLLISIONS	
	FATAL[1]	PERSONAL INJURY[2]
1992	3,073	169,640
1993	3,121	168,106
1994	2,837	164,642
1995	2,817	161,950
1996	2,740	153,944
1997	2,660	147,549
1998	2,583	145,615
1999	2,632	148,683
2000	2,547	153,300
2001*	2,413	148,996
2002	2,583	153,859
2003	2,487r	150,503r
2004	2,436	145,161r
2005	2,550r	145,572r
2006	2,587r	142,521r
2007	2,462	138,612
2008	2,192r	127,678r
2009	2,011r	123,516
2010	2,026r	123,141
2011	1,834	121,159



Linear Regression:





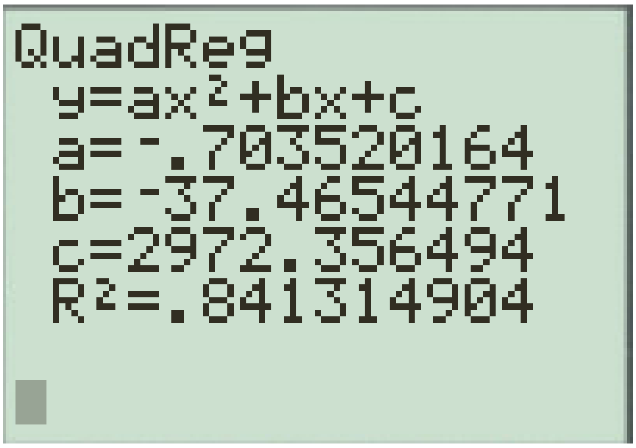
Equation: y = -50.832x + 3012.457

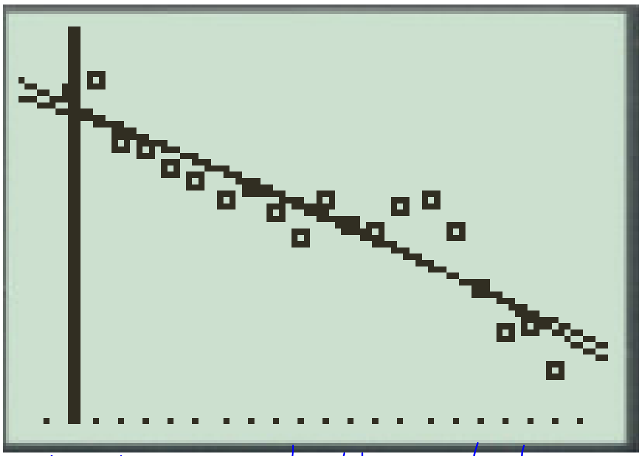
Initial Value: 3012.457

r^2: 0.837

percent confidence: 83.7%

Quadratic Regression:





*We see both models, over this time, they are very similar

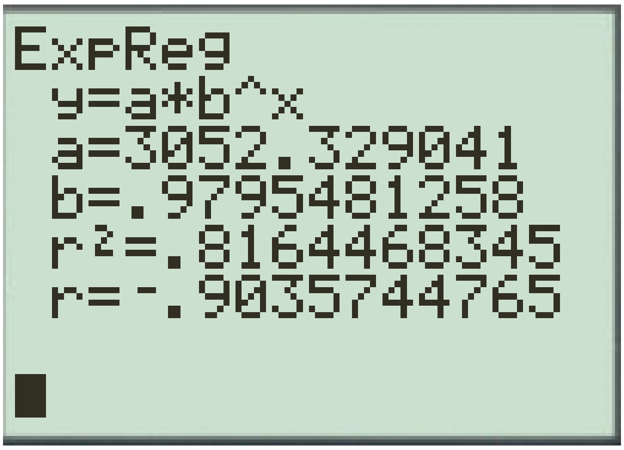
Equation: $y = -0.704x^2 - 37.465x + 2972.356$

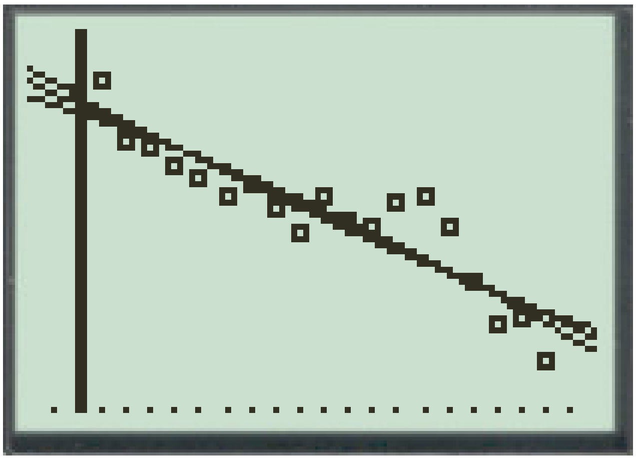
Initial Value: 2972.356

r^2: 0.841

percent confidence: 84.1%

Exponential Regression:





Equation: $y = 3052.329*0.980^x$

Initial Value: 3052.329

r^2: 0.816

percent confidence: 81.6%

Table 1.2

Type	Number of Fatal Collisions in					
	1900 -92	1930 -62	1950 -42	1970 -22	2030 38	2050 58
Linear	7,689	6,164	5,147	4,131	1,081	64
Quadratic	460	2,589	3,304	3,456	532	-1569
Exponential	19,581	10,681	7,131	4,761	1,417	946

*We started in 1992. All of our year values must be with respect to 1992. (1992 is year 0!)

Linear $y = -50.832x + 3012.457$

Quadratic $y = -0.704x^2 - 37.465x + 2972.356$

Exponential $y = 3052.329 * 0.980^x$

a. Describe the behaviour of the linear function over the time period included in the plot.

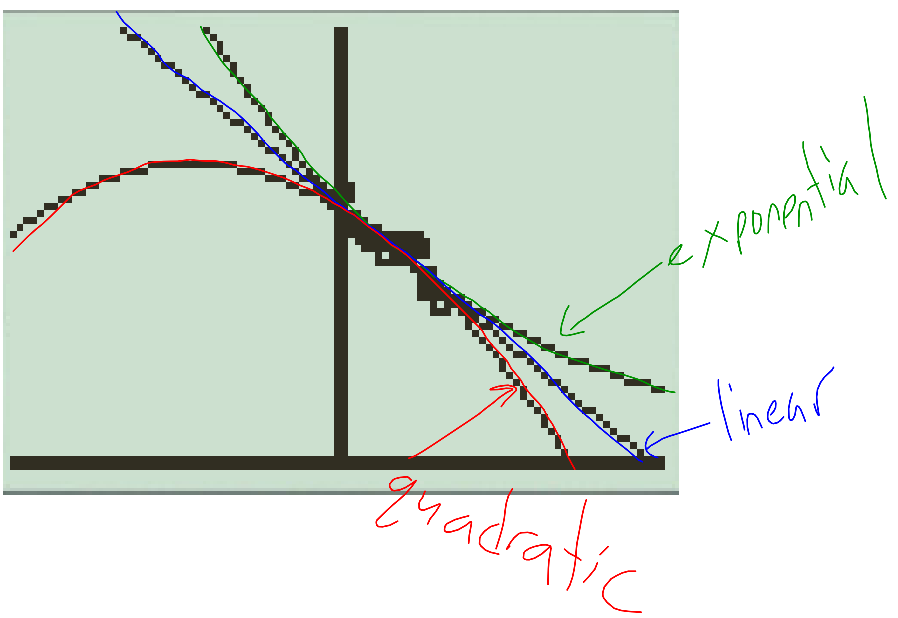
Constant decrease over time

b. Describe the behaviour of the quadratic function over the time period included in the plot.

The quadratic increases to a maximum and then decreases, the rate of change increases over time.

c. Describe the behaviour of the exponential function over the time period included in the plot.

The exponential decreases over time and its rate of change decreases (levels out)



Based on Table 1.2 and the scatter plots you just looked at on the TI-83,

a. Which model do you think is best at predicting into the future? Explain.

The exponential model seems to do a better job predicting into the future. It shows the number of accidents decreasing, but not reaching zero.

b. Which model do you think does the best job at predicting collisions before 1992? Explain.

I think the quadratic does the best job at predicting collisions before 1992. It shows accidents increasing into the past and then decreasing. The other two models show fatal accidents increasing continually. This doesn't make sense as fewer cars and slower speeds in the past would likely result in fewer fatal accidents, not more.

c. Based on everything you have done, which model do you think is the most reasonable? Explain.

It is difficult to choose one model as neither the quadratic nor the exponential do a great job predicting both the past and future. If I had to pick one, I would pick quadratic. It is possible that the number of fatal accidents will go down considerably over the coming decades with advances in safety and technology (self-driving cars)

*all three models do a good job at representing the trend between 1992 and 2011