



Graphs in Economics

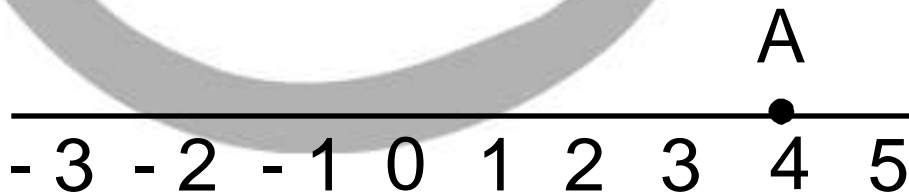
“Data! Data! Data!” he cried, impatiently.

“I can't make bricks without clay.”

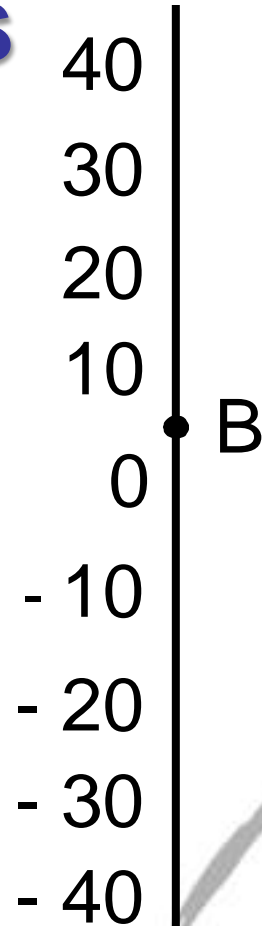
Sherlock Holmes (by Sir Arthur Conan Doyle)



Number Lines



horizontal number line
(X axis – usually shows the
independent variable)



vertical number line
(Y axis – usually shows
the dependent variable)



Independent & Dependent Variables

- **independent variable** – a variable that stands alone & isn't changed by other variables being measured ... Age might be an independent variable. Other variables (such as what people buy or how much they spend) aren't going to change their ages. When looking for some kind of relationship between variables we try to see if the independent variable causes some kind of change in the other variables.
- **dependent variable** – a variable that depends on other variables ... A test score could be a dependent variable because it could change depending on several other variables such as study time, sleep or hunger. When looking for a relationship between two variables we try to find out what makes the dependent variable change the way it does.



Independent & Dependent Variables

Many people have trouble deciding which variable is independent & which is dependent. An easy way to figure it out is to insert the names of the two variables you're using in the following sentence in the way that makes the most sense.

(independent variable) causes a change in

(dependent variable) & it isn't possible that

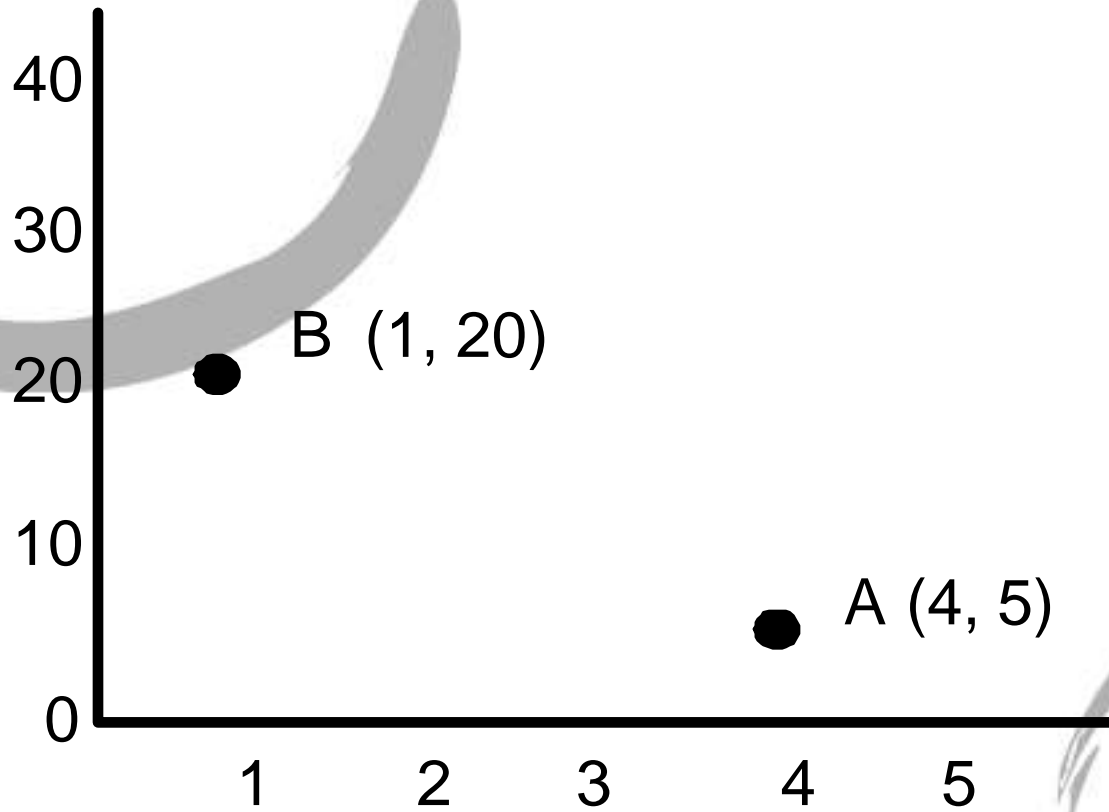
(dependent variable) could cause a change in

(independent variable).

[Try it out using *age & items purchased* as your two variables.] 4

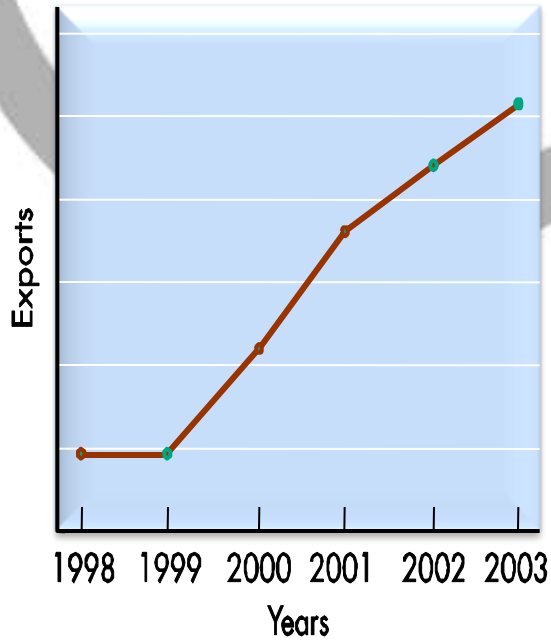


Coordinate System

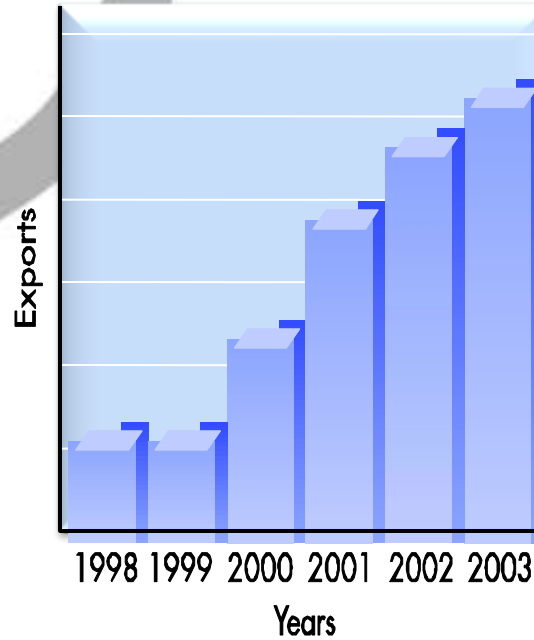




Presenting Information Visually



(a) Line graph



(b) Bar graph



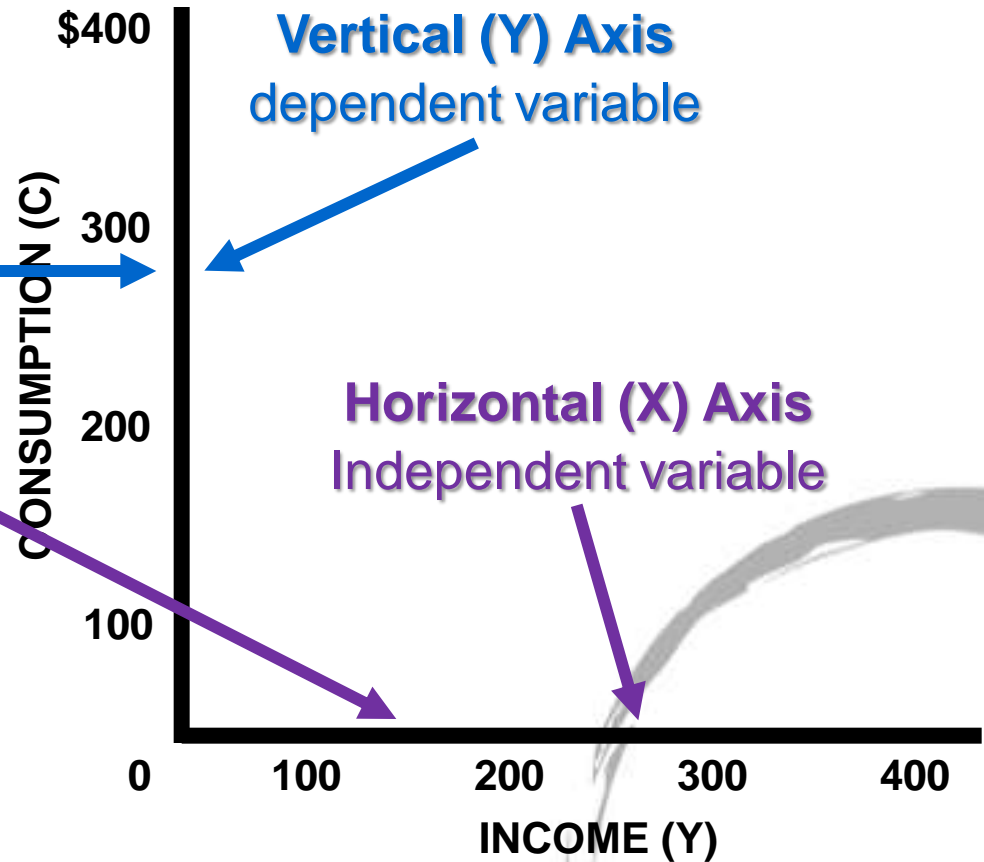
(c) Pie chart



Construction of a Graph

Table of Values

INCOME (per week)	CONSUMPTION (per week)
\$ 0	\$ 50
100	100
200	150
300	200
400	250





The Slope of a Line

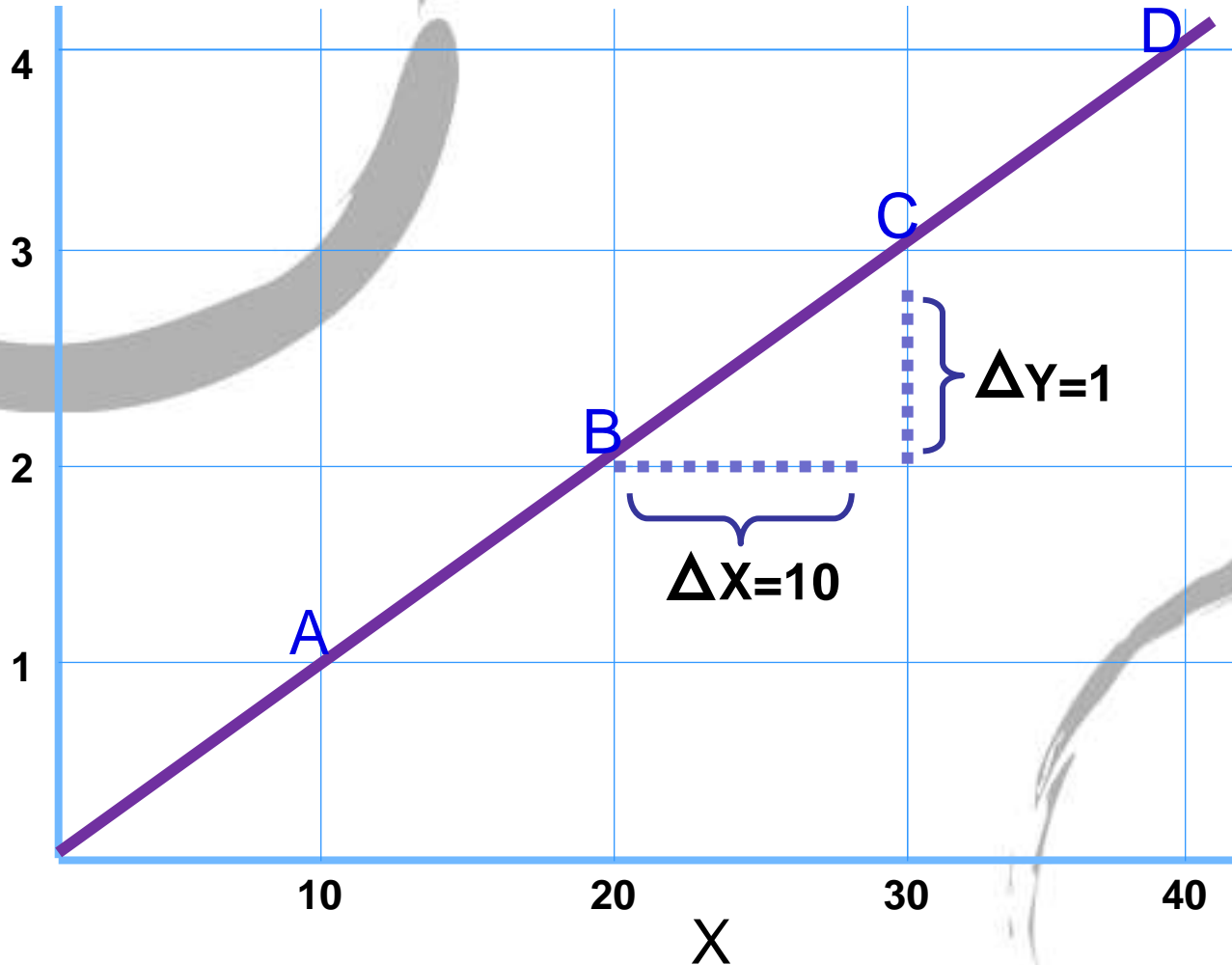
the ratio of change in the variable on the vertical axis (the rise or fall) to change in the variable on the horizontal axis (the run)

$$\text{Slope} = \text{rise/run} = \Delta \text{vertical axis} / \Delta \text{horizontal axis} = \Delta Y / \Delta X$$

[where Δ means *change in*]



Positive Slope

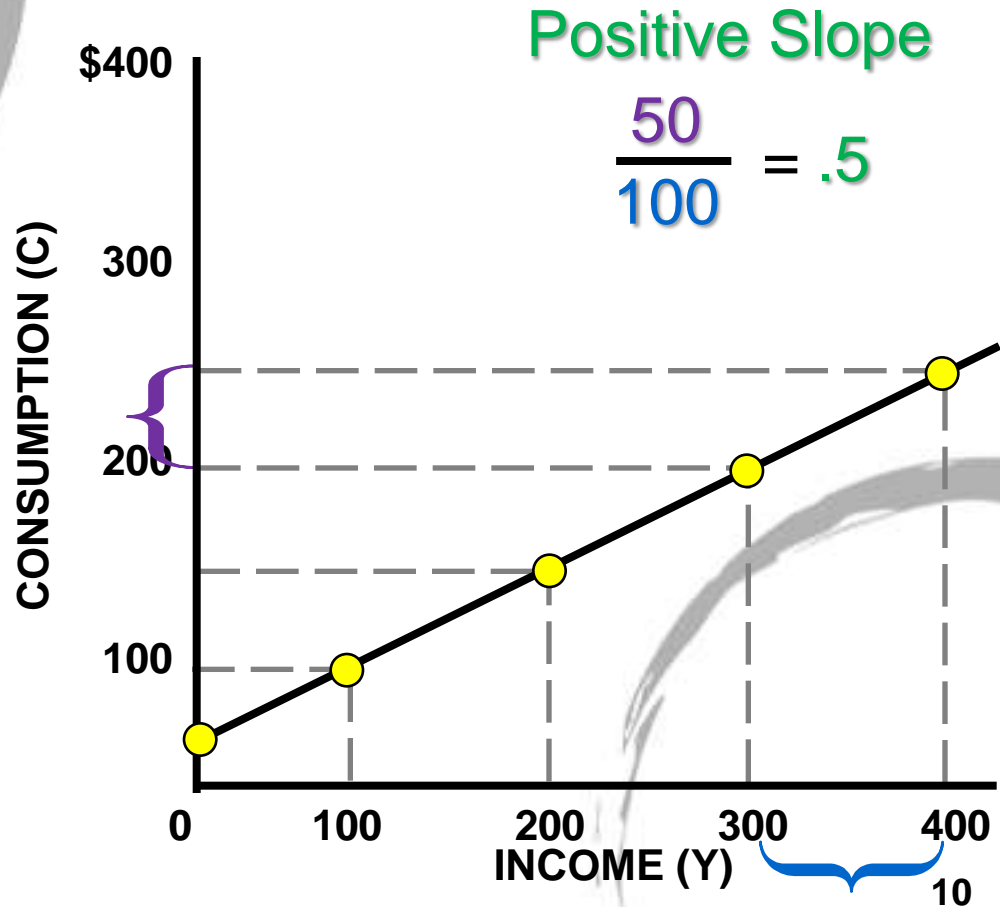




Positive Slope

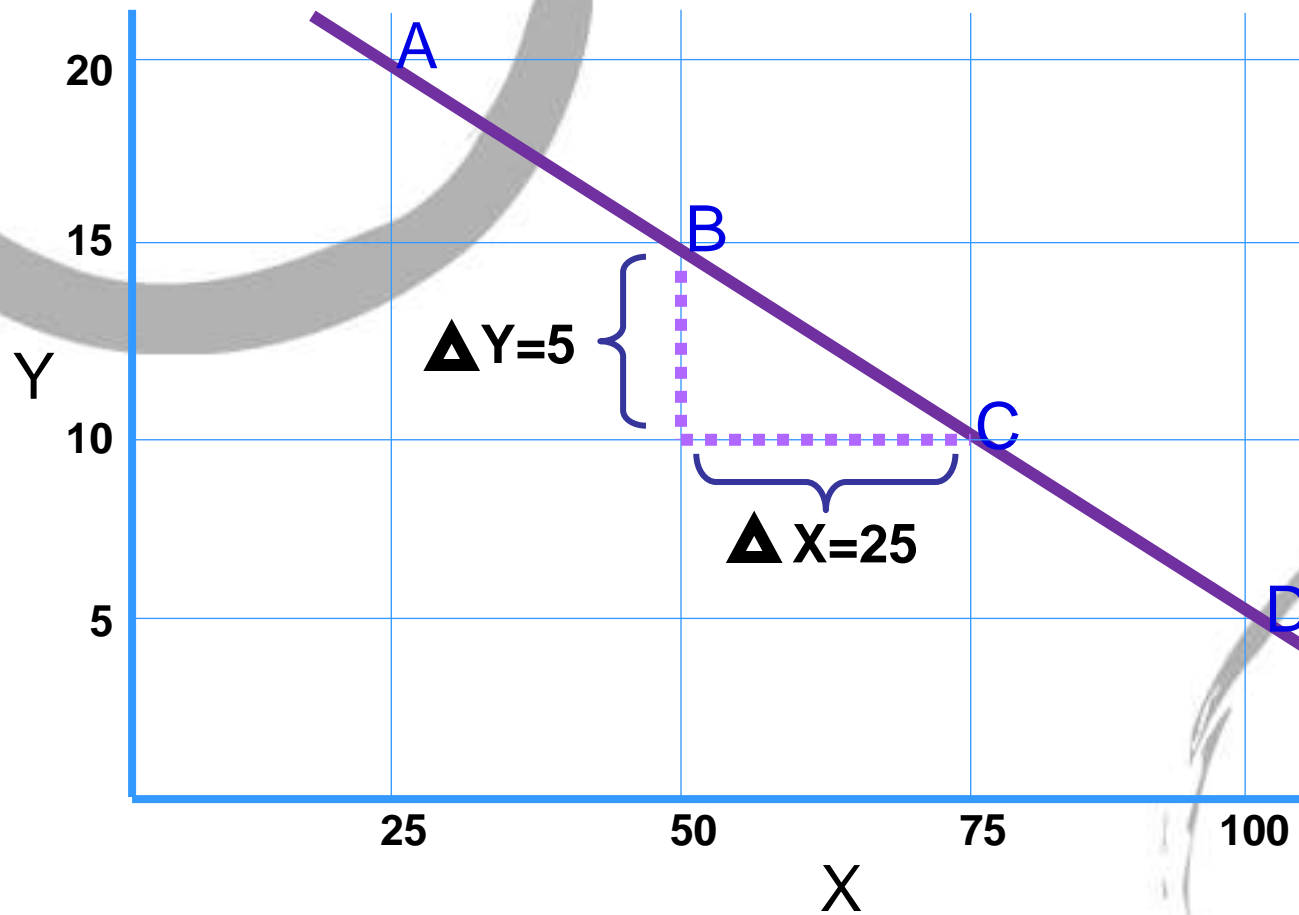
$$\frac{\text{Vertical Change}}{\text{Horizontal Change}}$$

INCOME (per week)	CONSUMPTION (per week)
\$ 0	\$ 50
100	100
200	150
300	200
400	250





Negative Slope

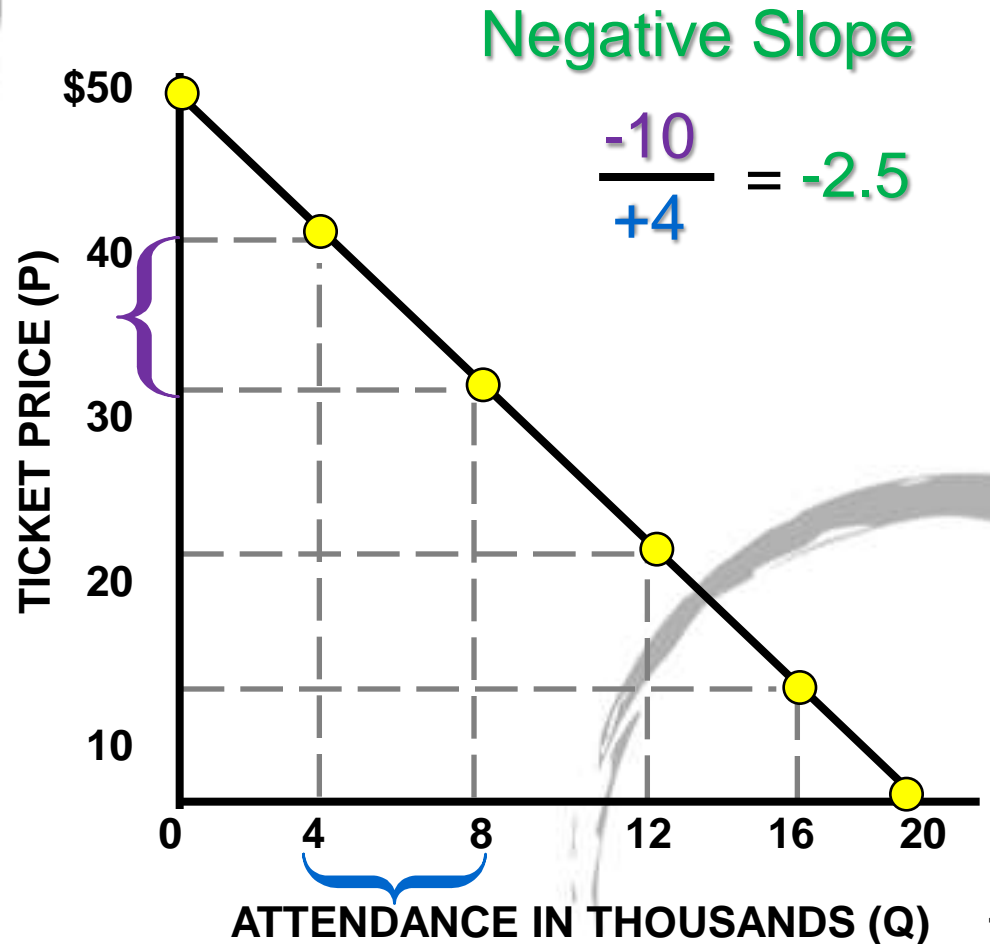




Negative Slope

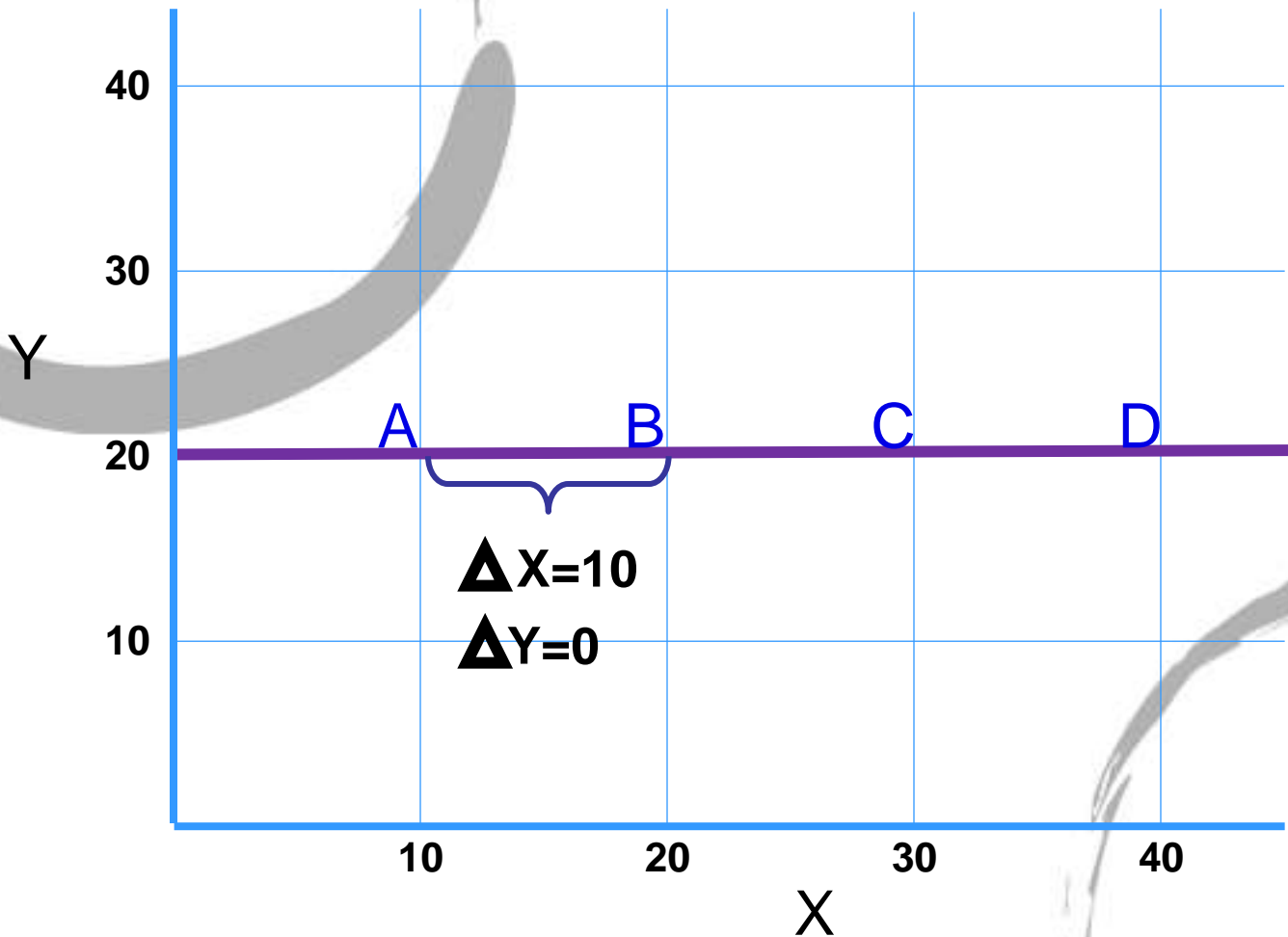
$$\frac{\text{Vertical Change}}{\text{Horizontal Change}}$$

TICKET PRICE	ATTENDANCE (thousands)
\$ 50	0
40	4
30	8
20	12
10	16
0	20



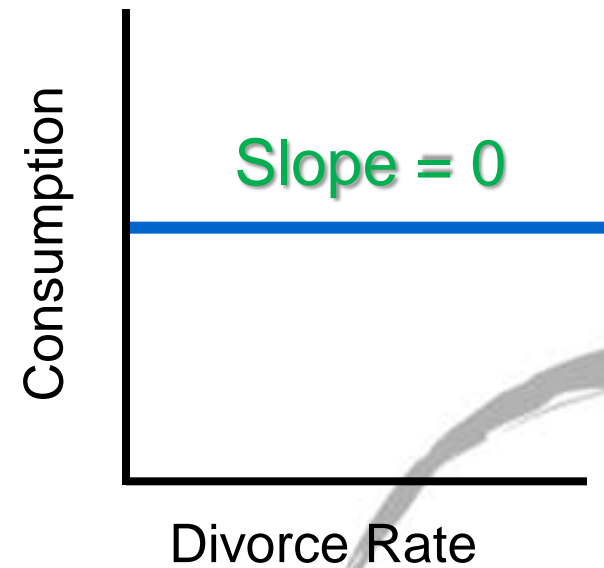


Zero Slope



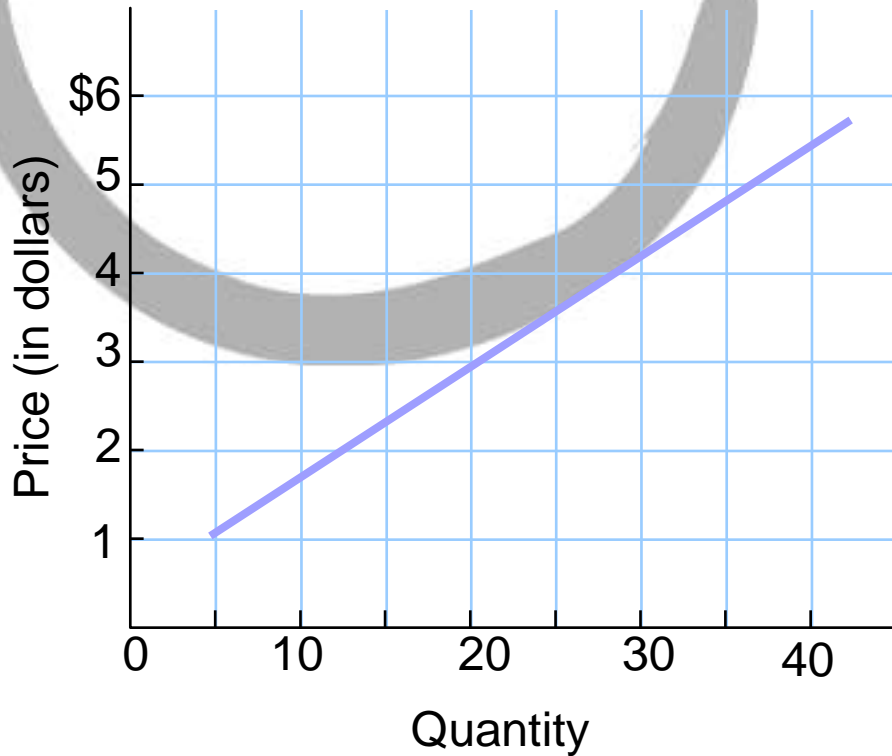


Infinite & Zero Slopes

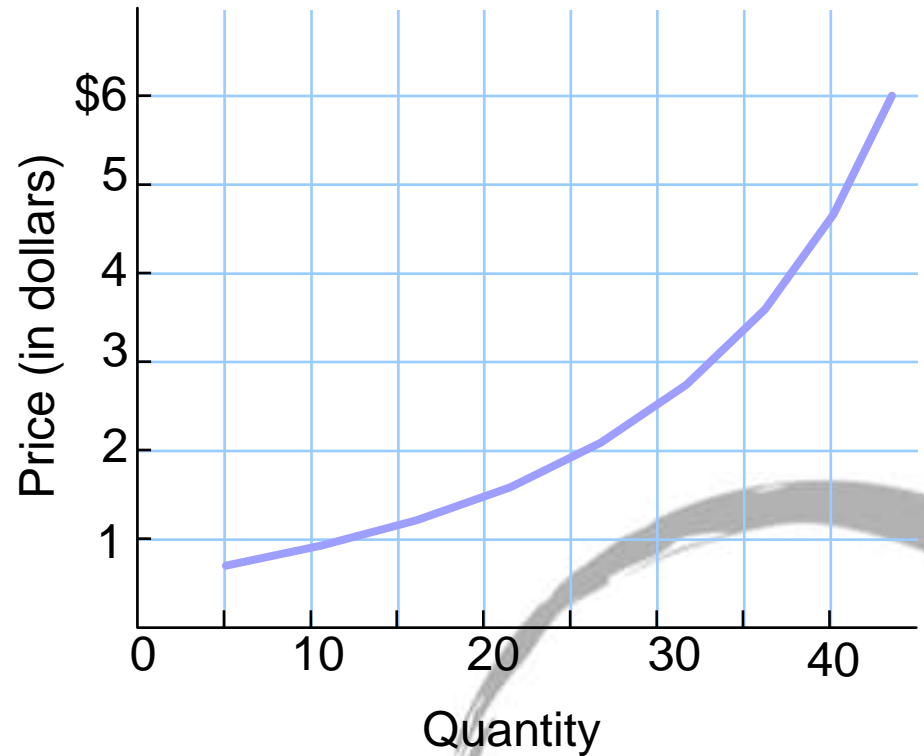




Linear & Nonlinear Curves



Linear Curve



Nonlinear Curve



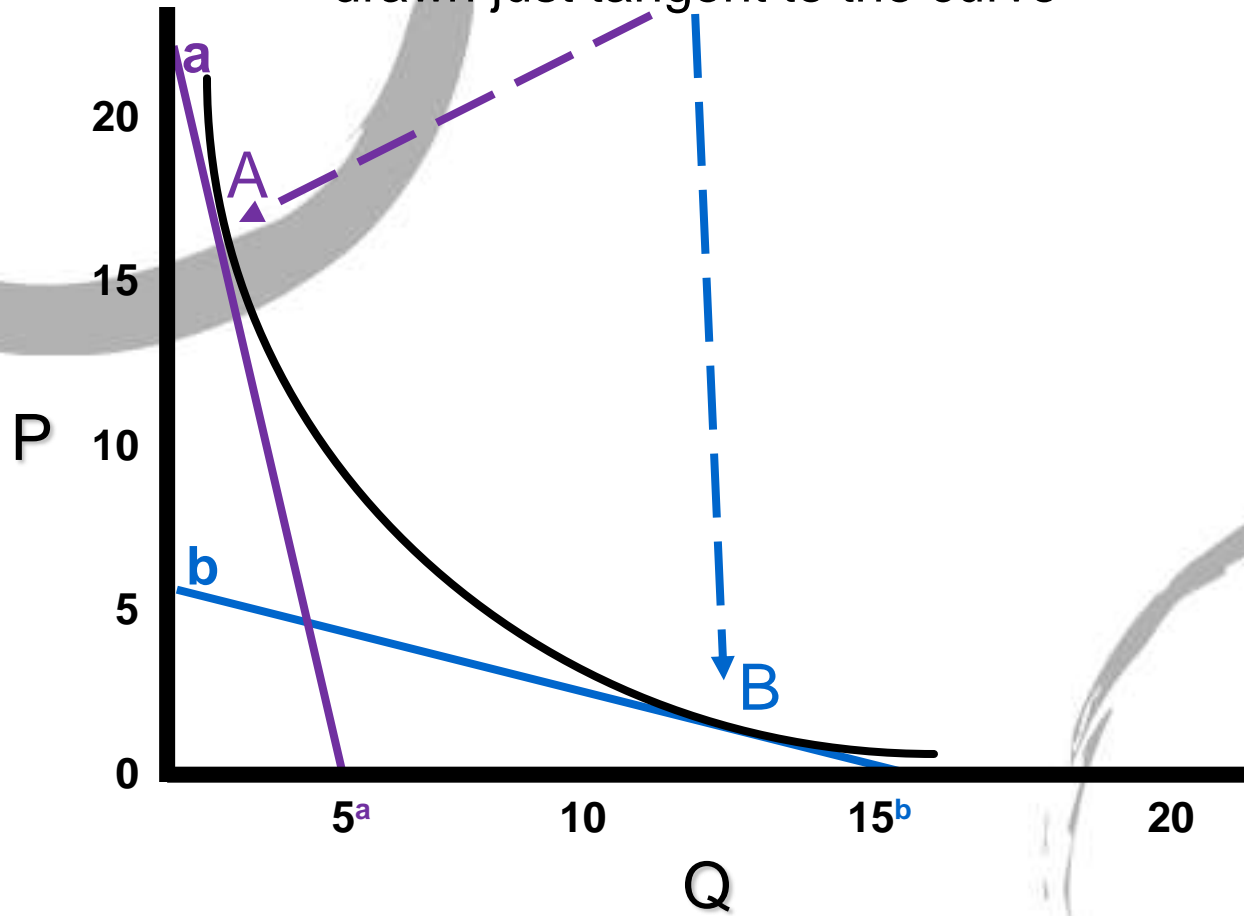
Nonlinear Slopes

The slope of a curve can vary along the curve.



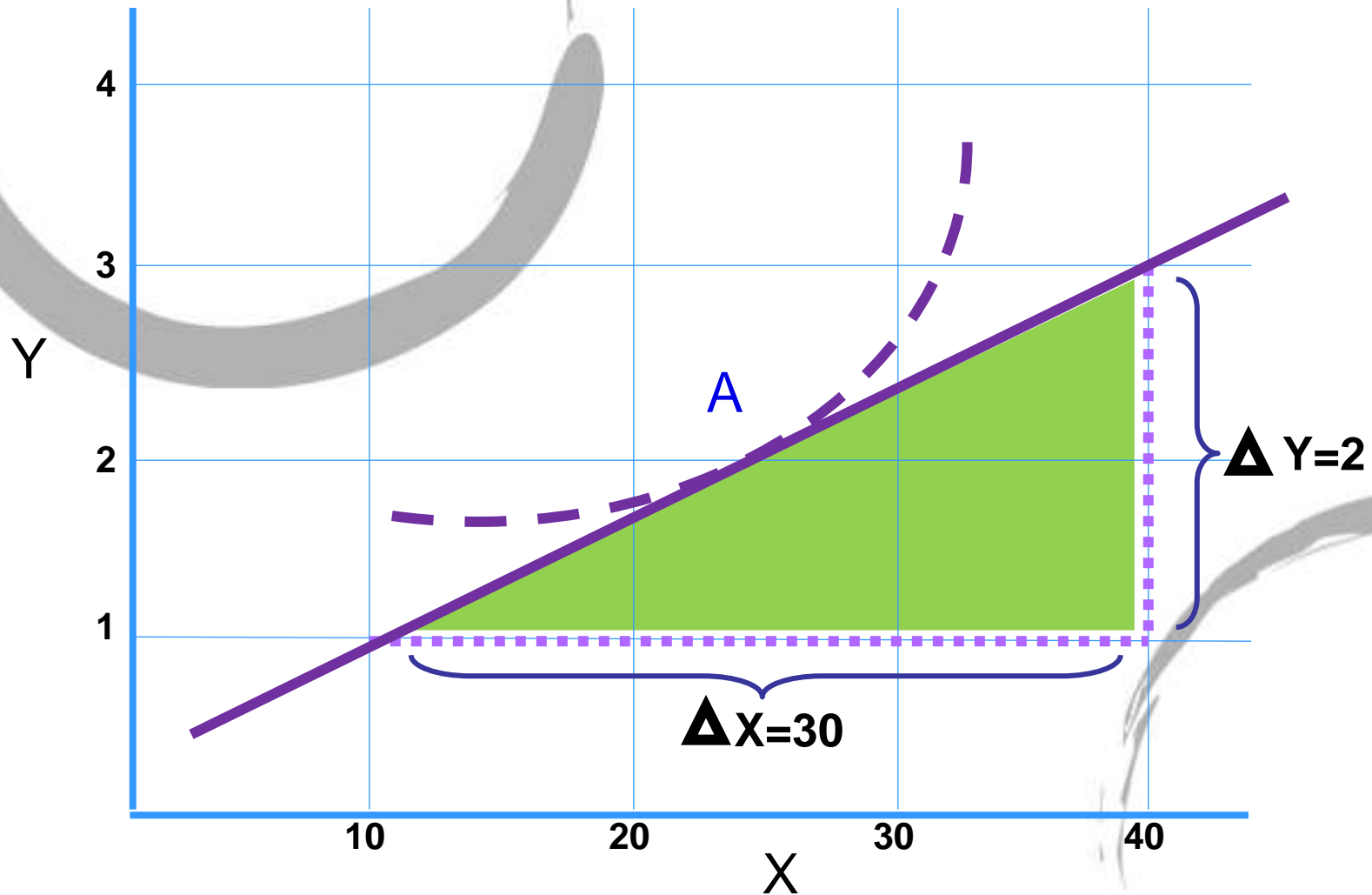
Nonlinear Slope

the slope of a straight line drawn just tangent to the curve



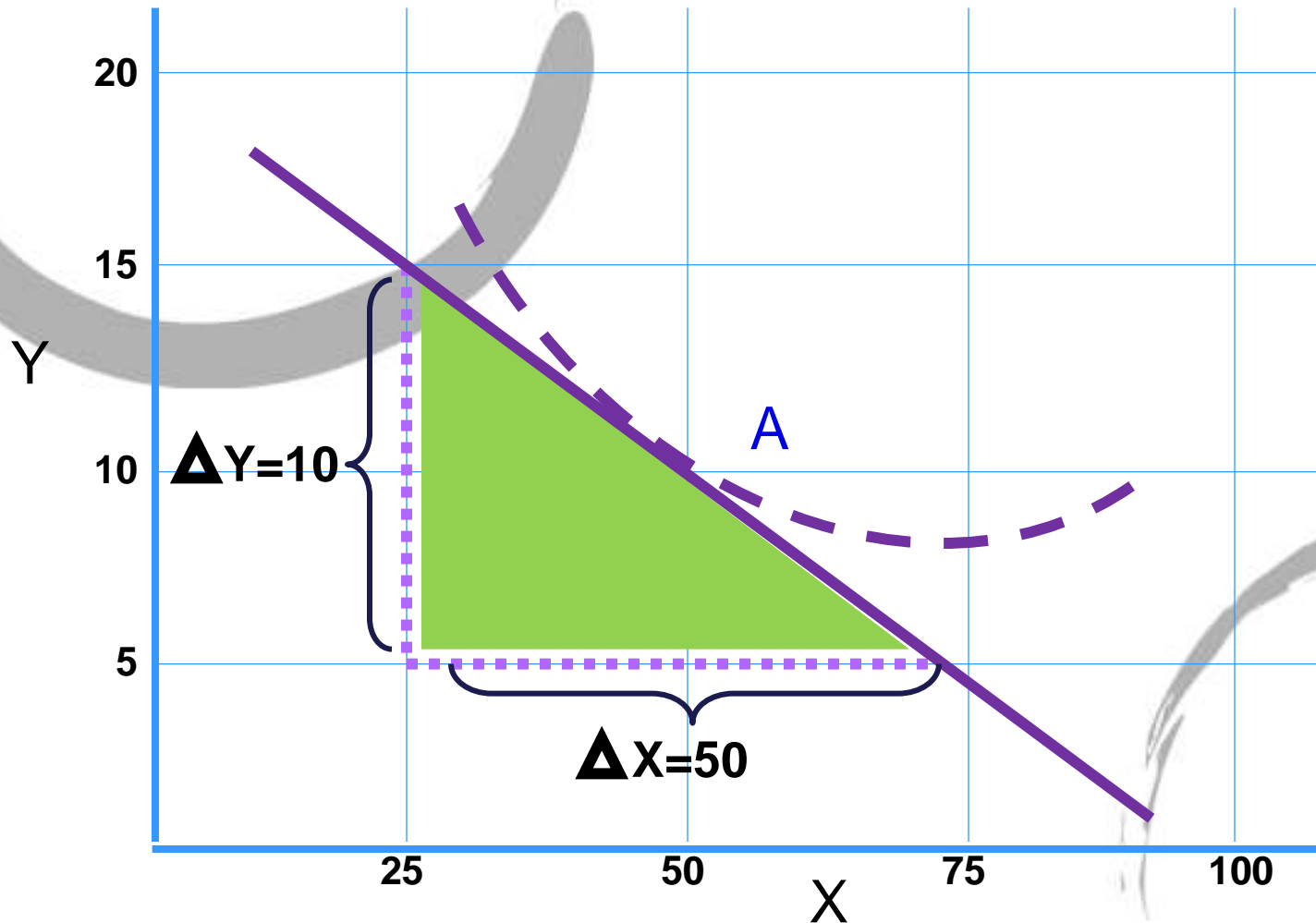


Nonlinear Slope



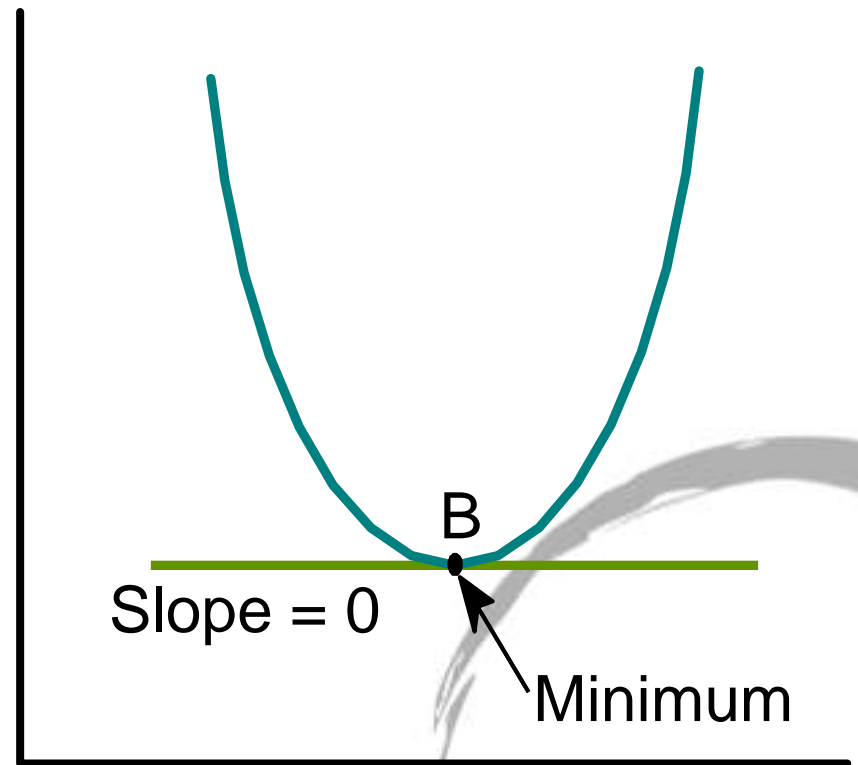
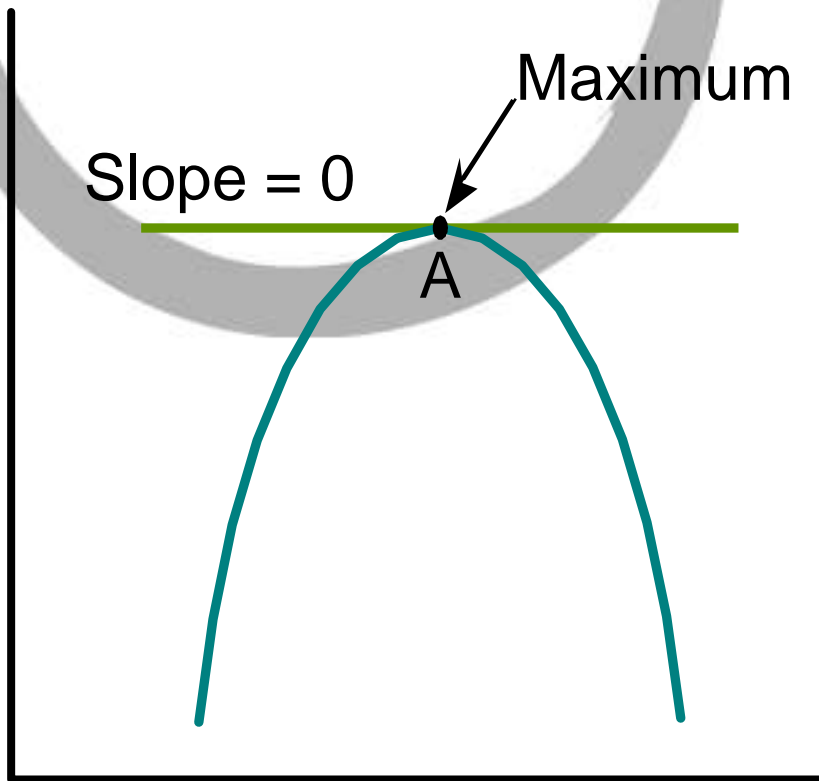


Nonlinear Slope



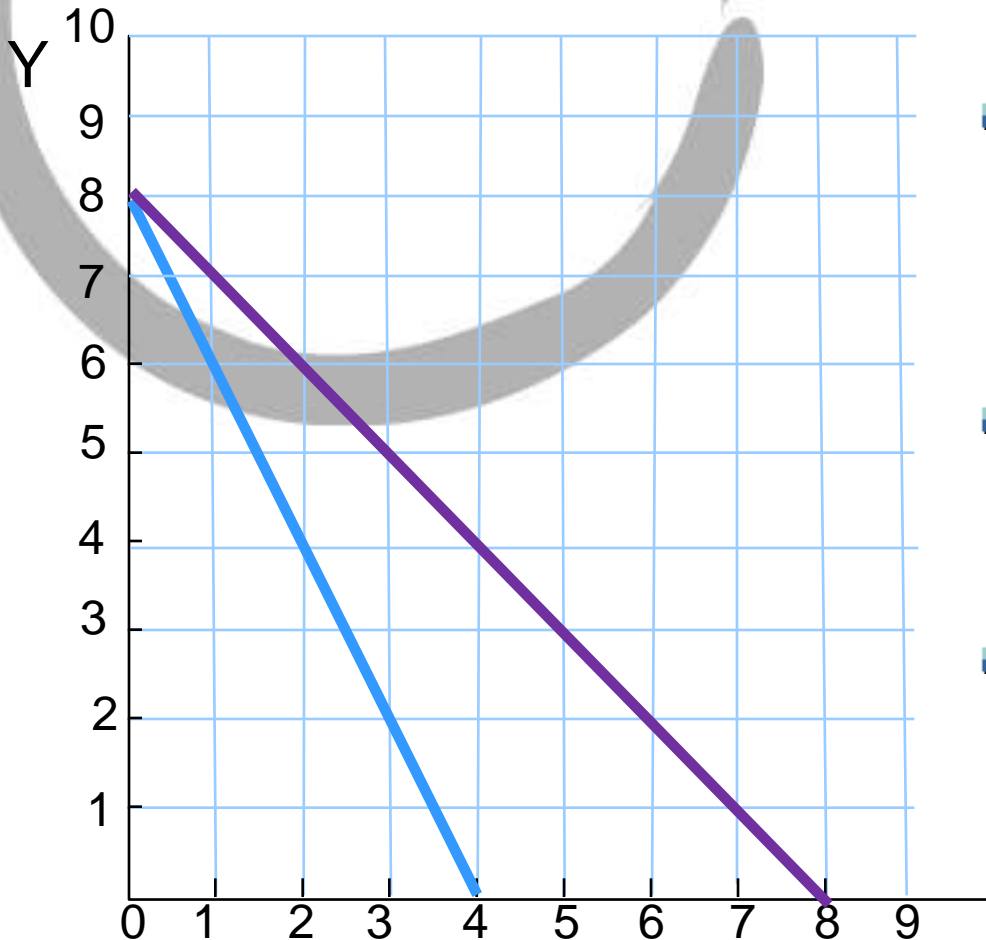


Maximum & Minimum Points





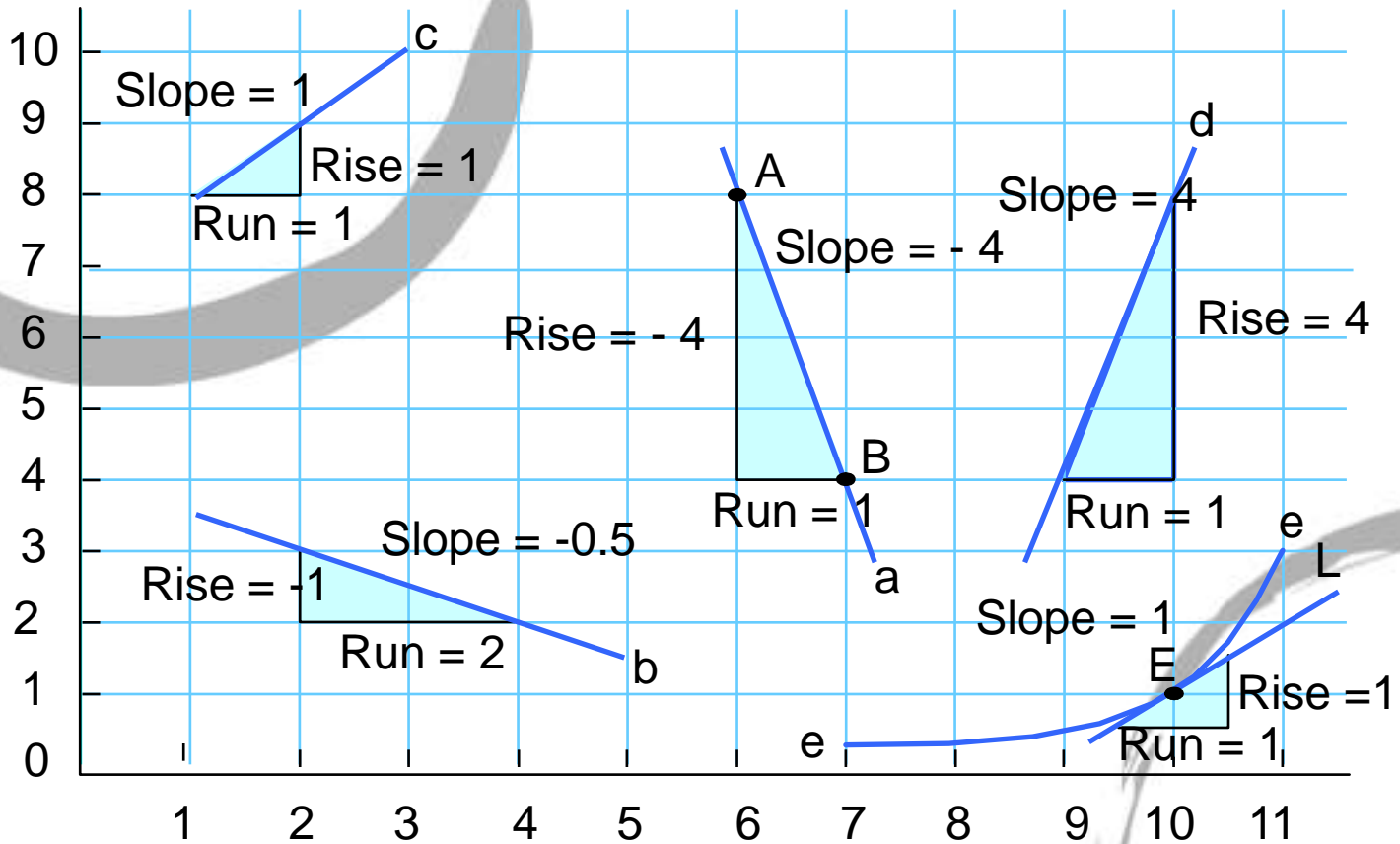
Equations & Graphs



- A linear graph can be expressed as an equation in the form $y = mx + b$ where m is the *slope* & b is the vertical *intercept*.
- The *slope* of the blue line is $8/-4 = -2$ & the *intercept* is 8, so the equation is $y = -2x + 8$.
- The *slope* of the purple line is $8/-8$. The *intercept* is 8, so its equation is $y = -x + 8$.



Slopes of Curves

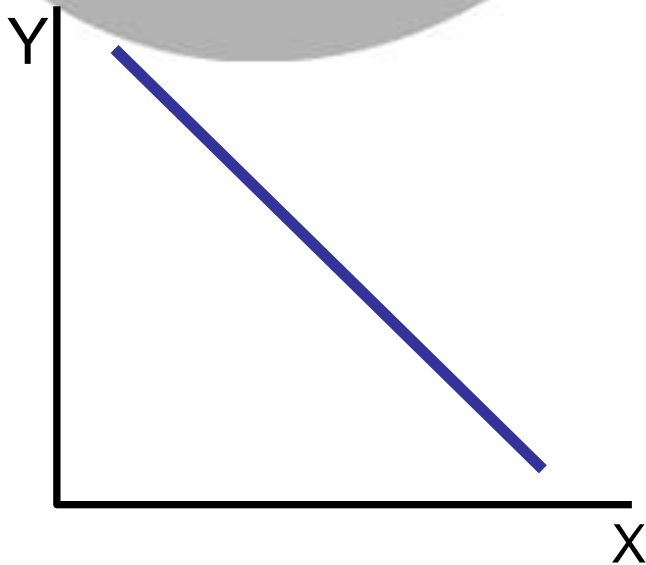




Inverse & Direct Relationships

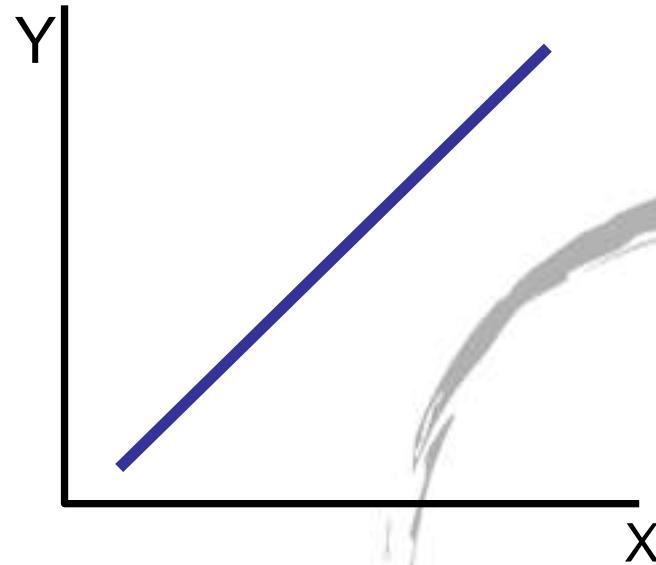
Inverse relationship:

When X goes up, Y goes down.
When X goes down, Y goes up.



Direct relationship:

When X goes up, Y goes up.
When X goes down, Y goes down.





Direct Relationship Between Two Variables

When one variable increases, the other variable increases & vice versa.



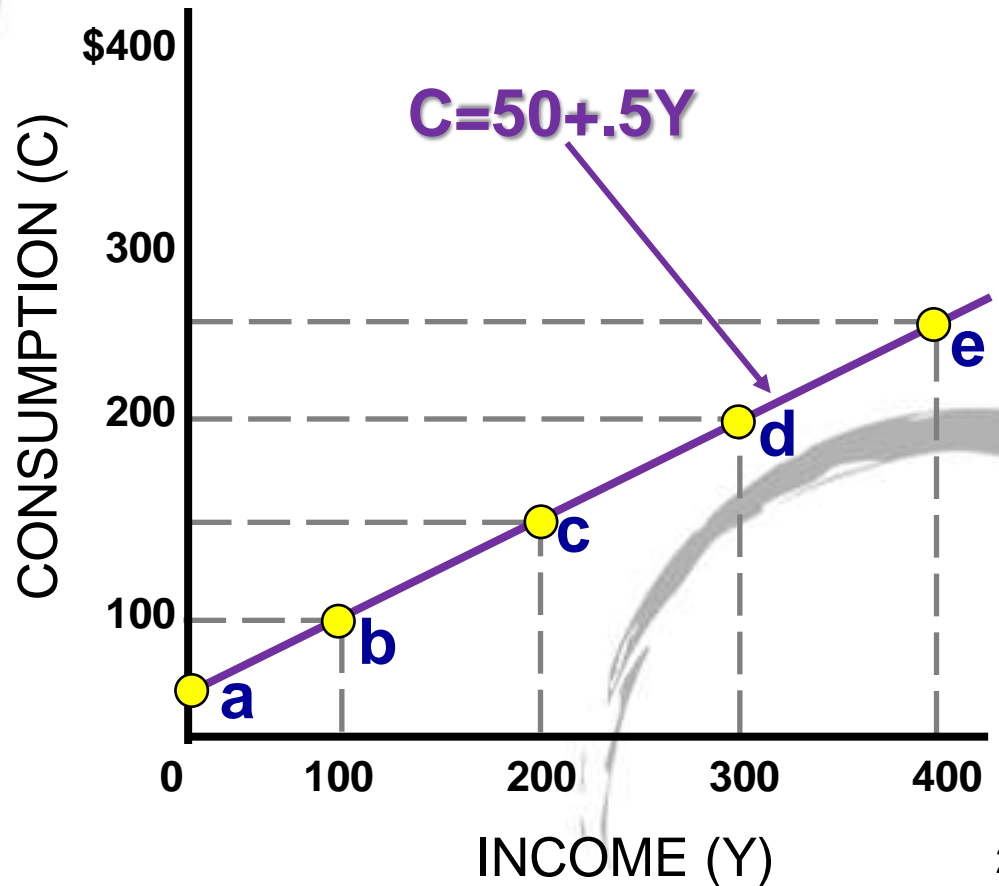
Direct Relationship

Personal Expenditure	Annual Income
\$1,000	\$10,000
\$2,000	\$20,000
\$3,000	\$30,000
\$4,000	\$40,000



Direct Relationship

INCOME (per week)	CONSUMPTION (per week)
\$ 0	\$ 50 a
100	100 b
200	150 c
300	200 d
400	250 e





Inverse Relationship Between Two Variables

When one variable increases, the other variable decreases & vice versa.



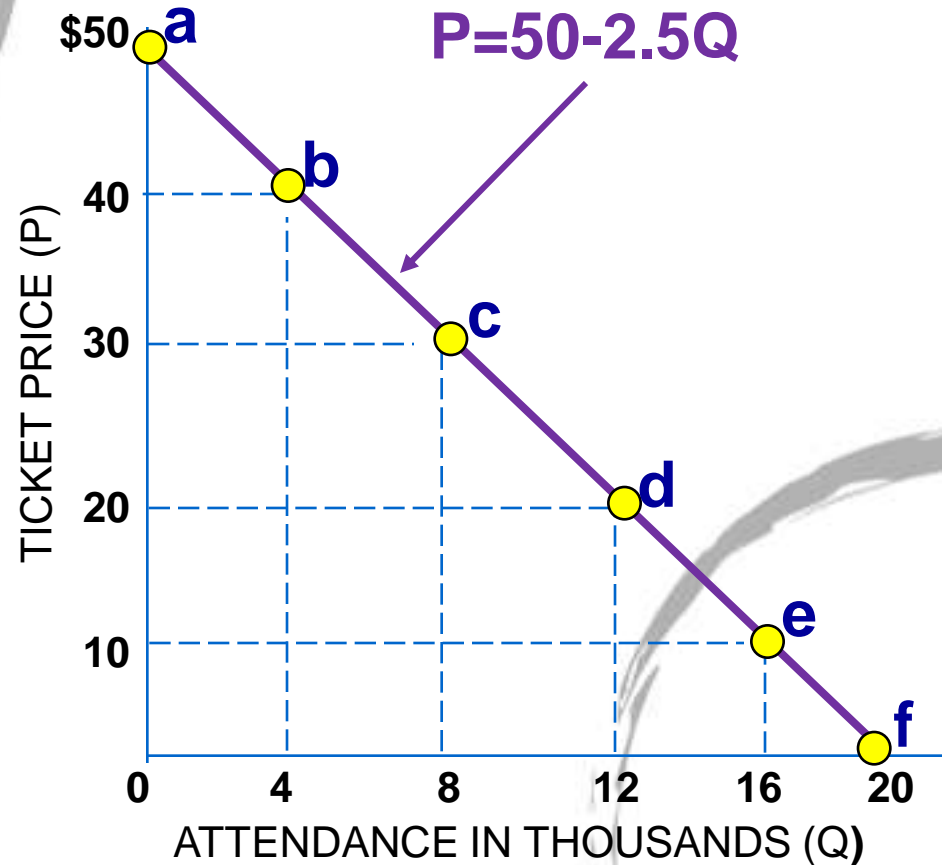
Inverse Relationship

Price per CD	Quantity of CDs
\$20	25,000,000
\$15	50,000,000
\$10	75,000,000
\$5	100,000,000



Inverse Relationship

TICKET PRICE	ATTENDANCE (thousands)
\$ 50	0 a
40	4 b
30	8 c
20	12 d
10	16 e
0	20 f





Independent Relationship Between Two Variables

When one variable changes, the other variable is unchanged & vice versa.



Independent Relationship

Personal Expenditure	Annual Income
\$20	\$10,000
\$20	\$20,000
\$20	\$30,000
\$20	\$40,000



Slope of a Line in Equation Form

$$y = a + bX$$

$$C = 50 + .5Y$$

$$P = 50 - 2.5 Q$$



Movement Along a Curve vs. Curve Shift

When price changes, the result is always *movement* along the supply or demand curve.

When something other than price changes, the whole supply or demand curve *shifts*.



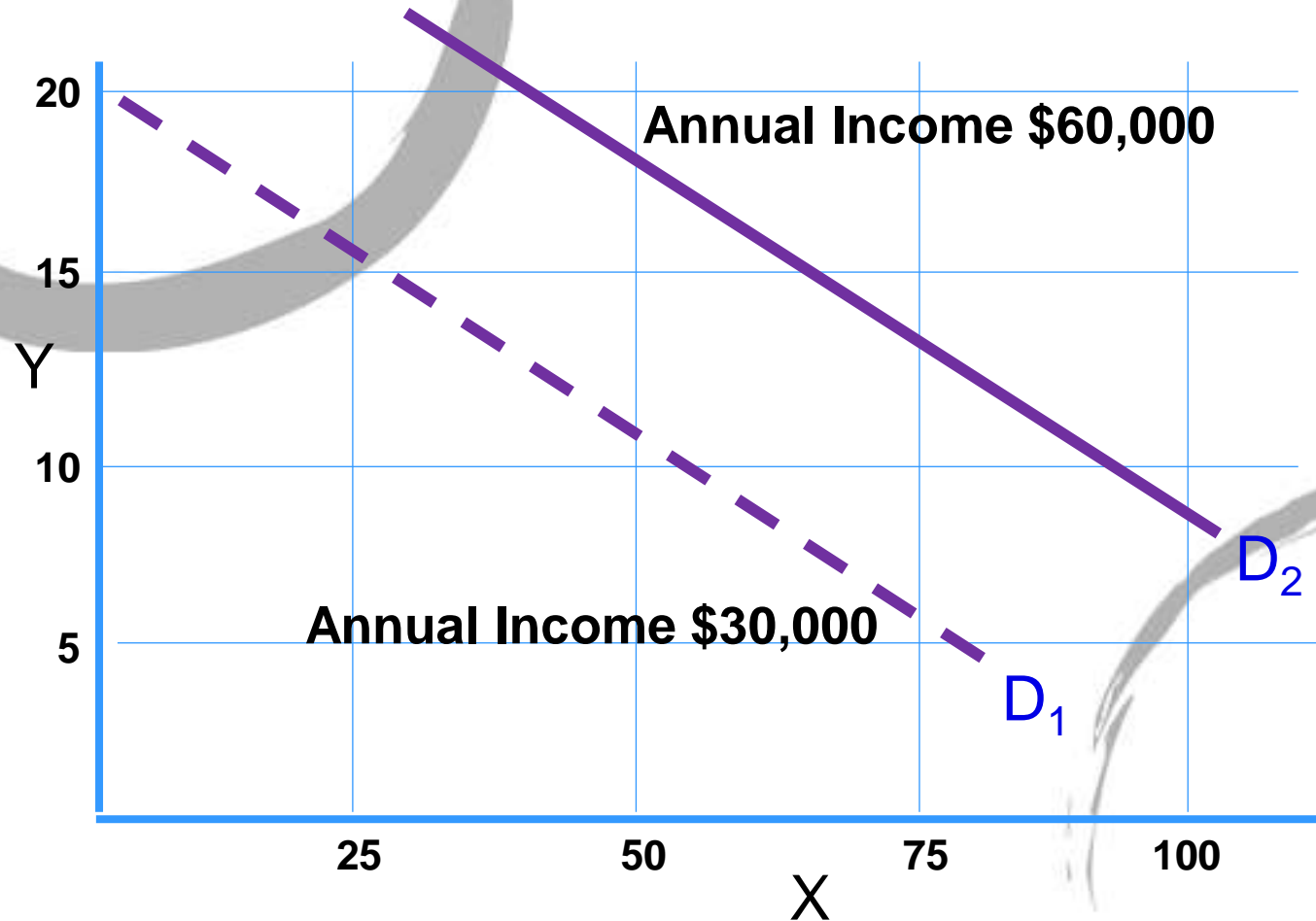
Example of a Change Other than Price

When income increases the whole demand curve shifts upward.

For other changes that can shift a curve, see the determinants of demand list & the determinants of supply list given in the *Core Concepts* presentations.



Demand Curve Shift





Test Yourself!

Which is the X axis & which is the Y axis?
Which axis represents the dependent variable & which the independent variable?



How Did You Do?

**Y axis
dependent variable**



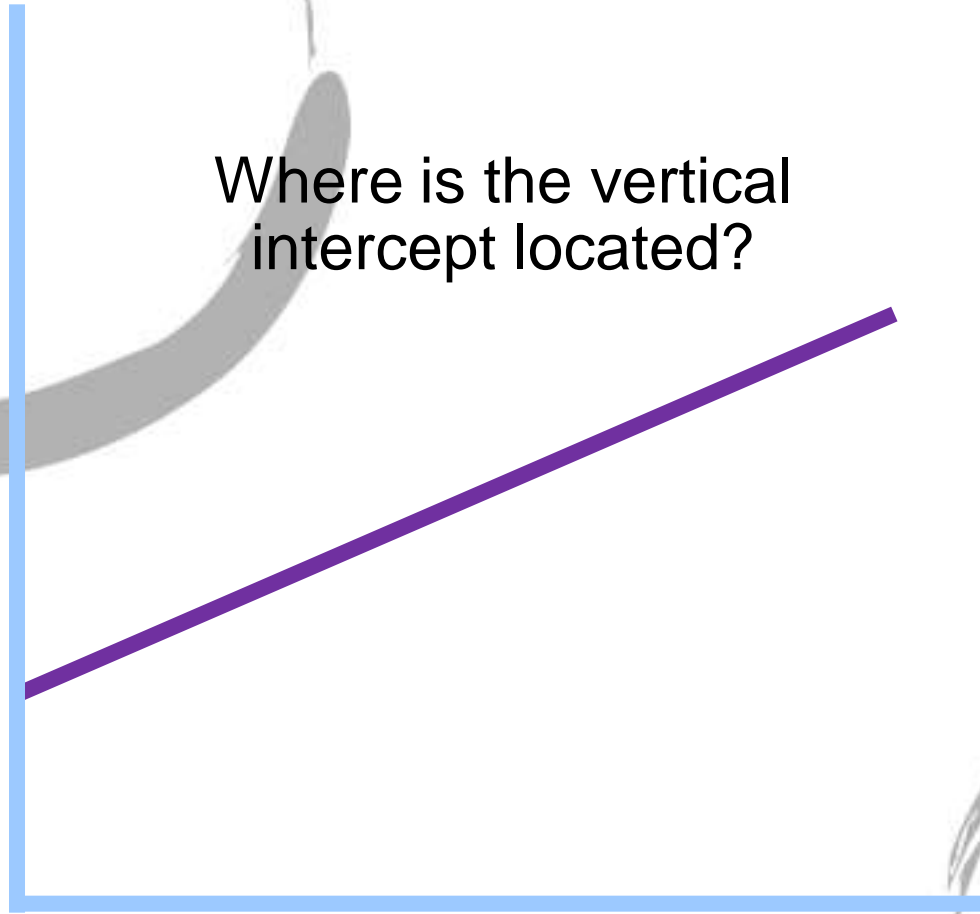
**X axis
independent variable**





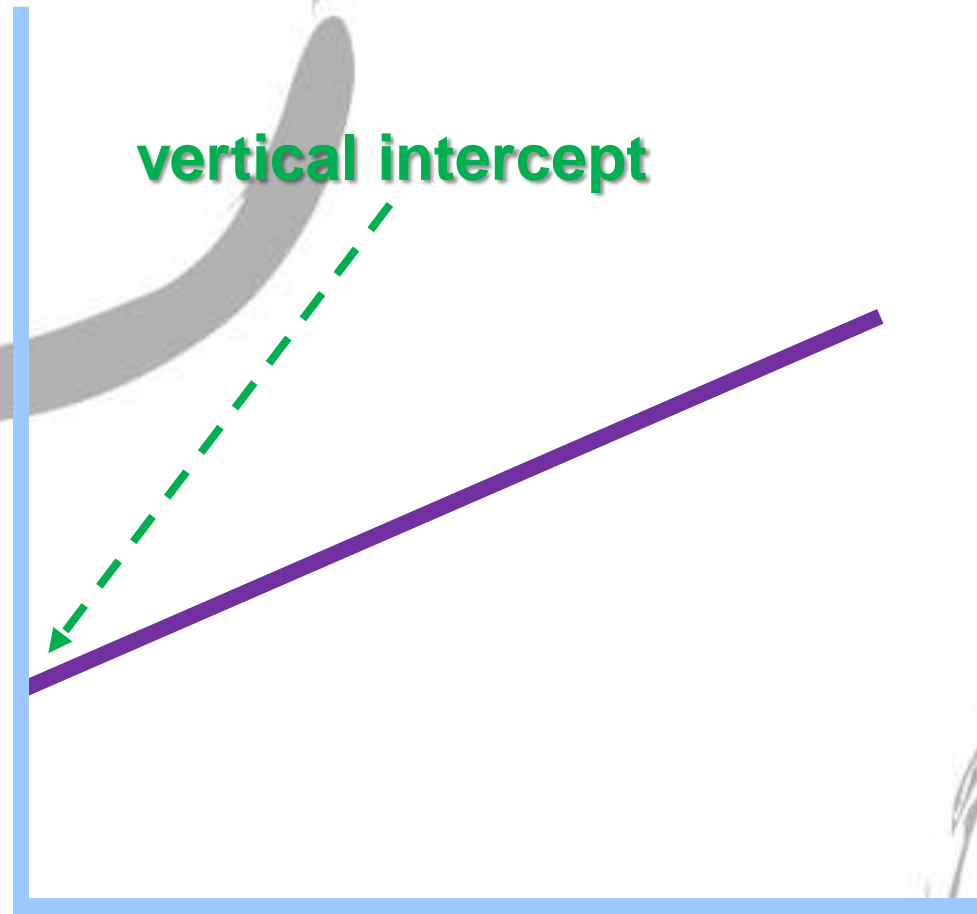
Test Yourself!

Where is the vertical intercept located?





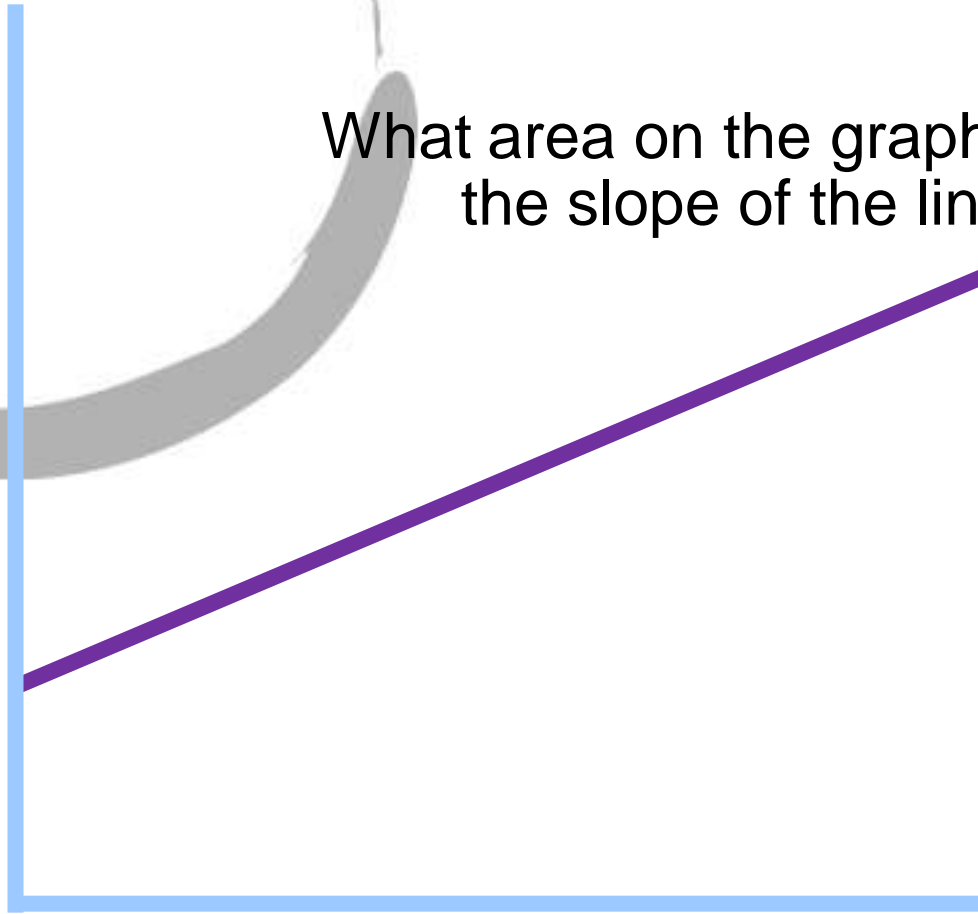
How Did You Do?





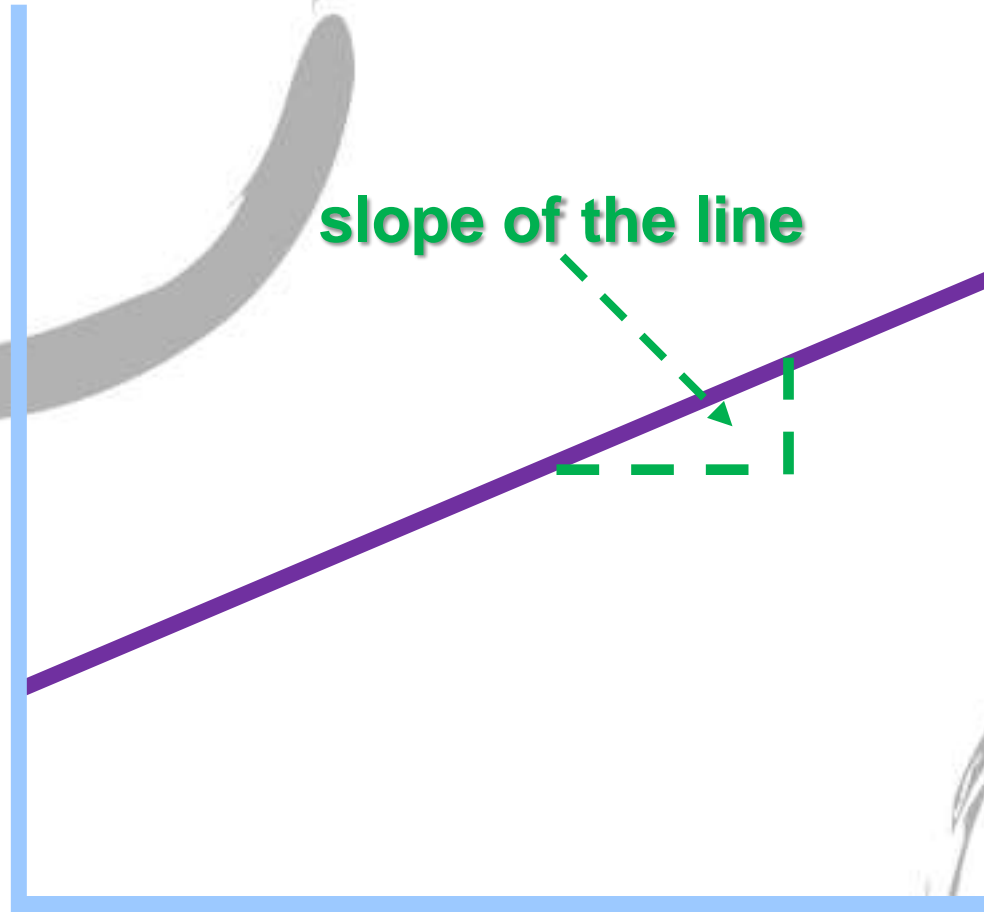
Test Yourself!

What area on the graph shows the slope of the line?



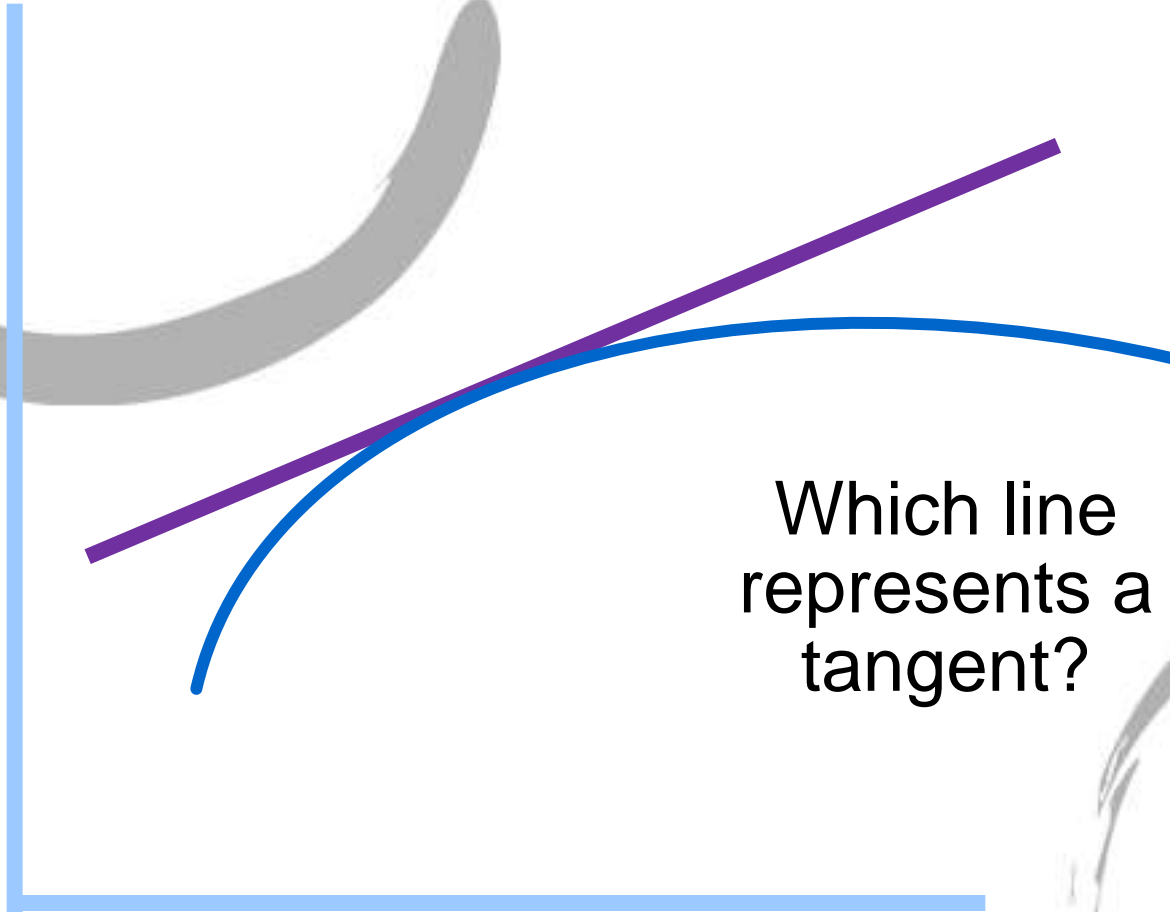


How Did You Do?





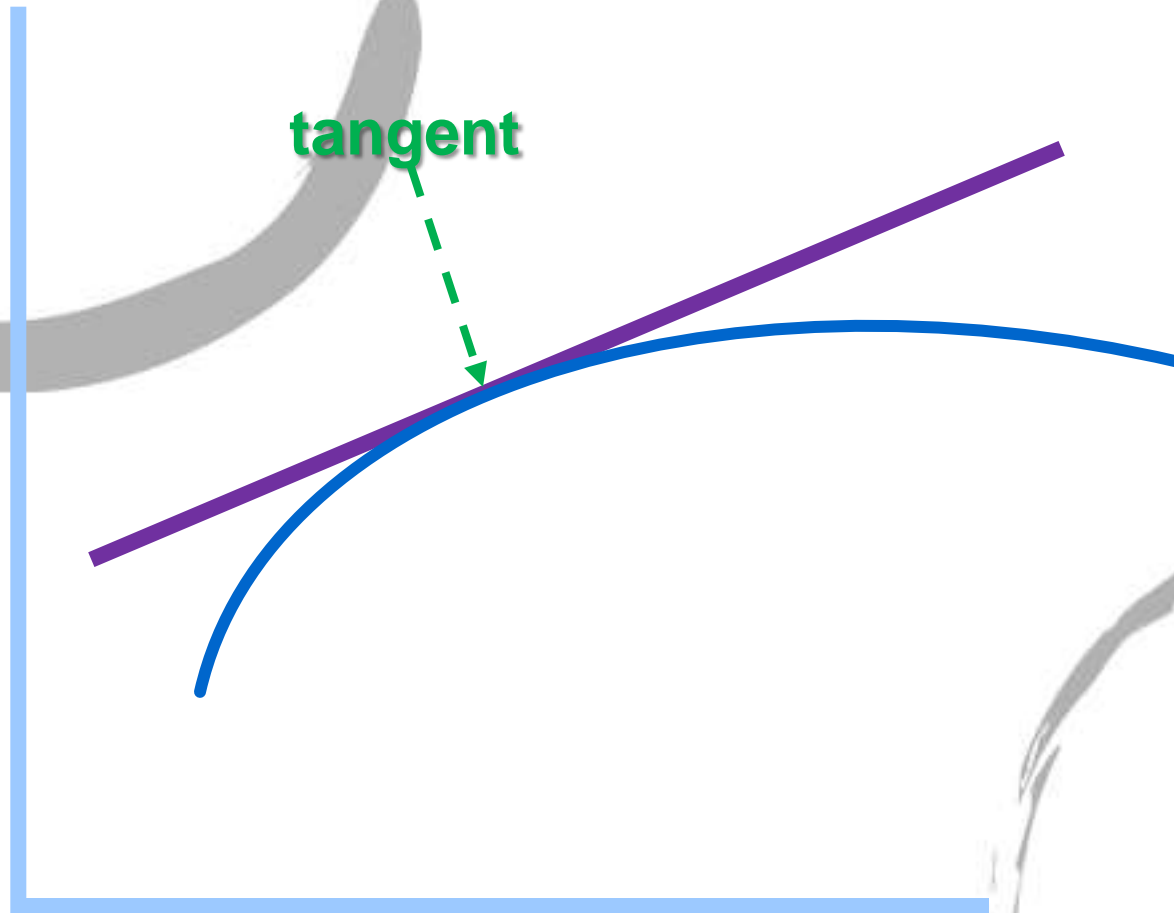
Test Yourself!



Which line
represents a
tangent?

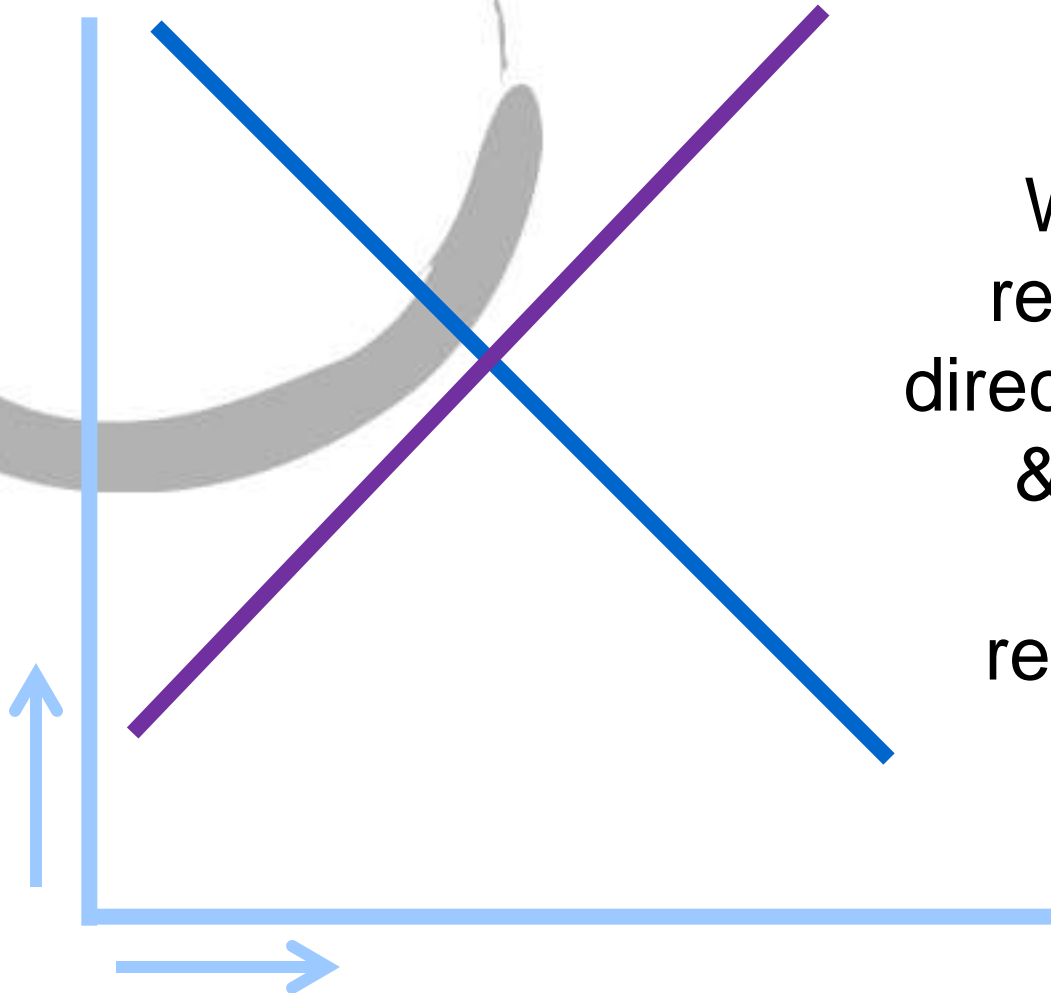


How Did You Do?





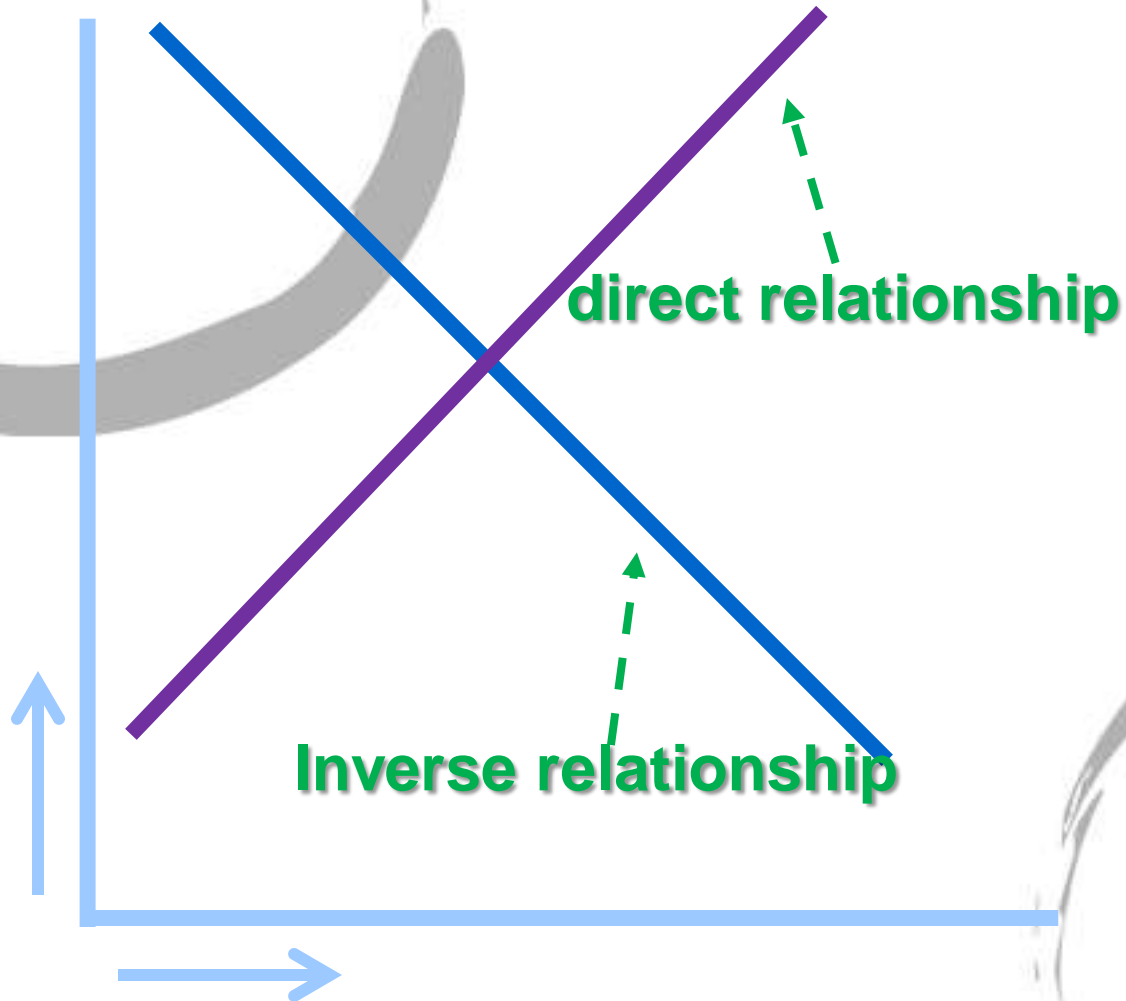
Test Yourself!

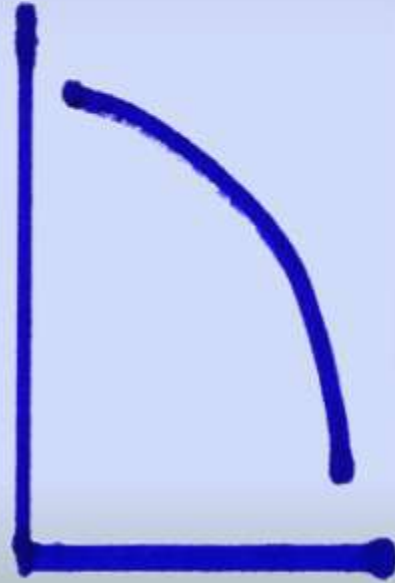
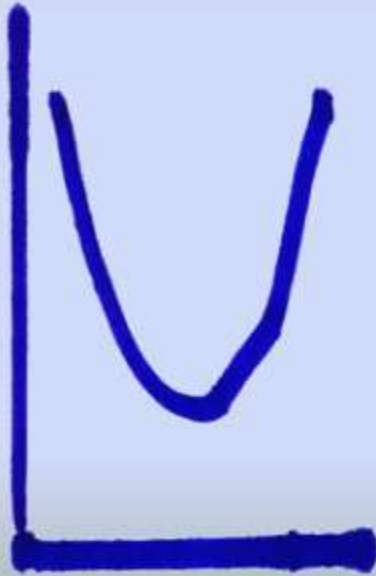
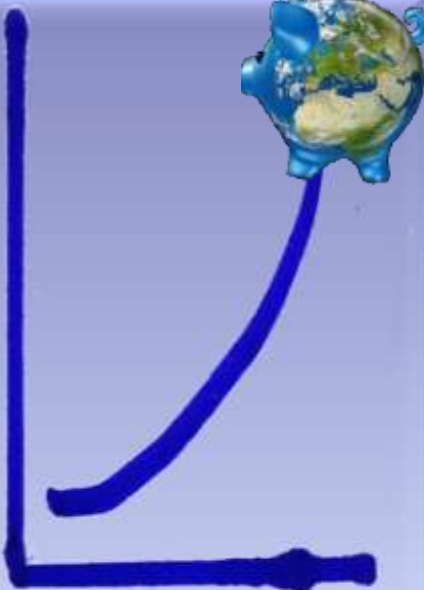
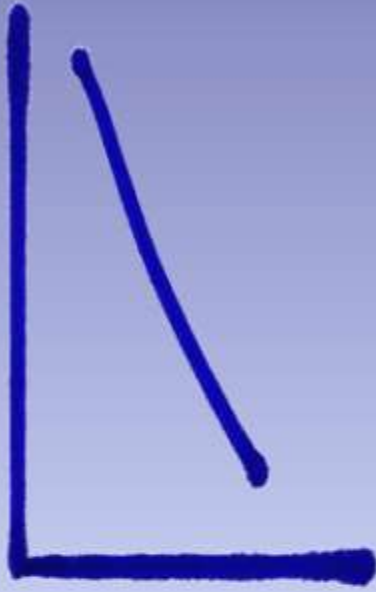
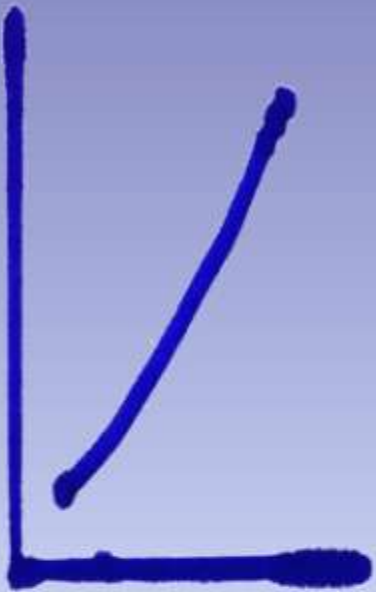


Which line represents a direct relationship & which an inverse relationship?



How Did You Do?





THE END