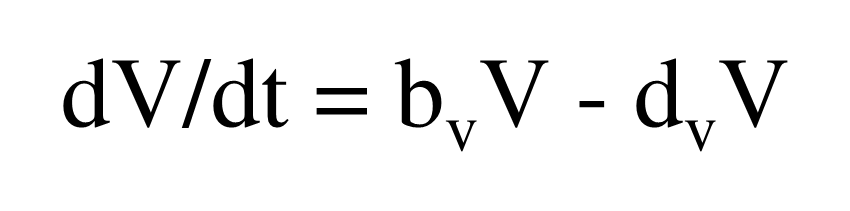
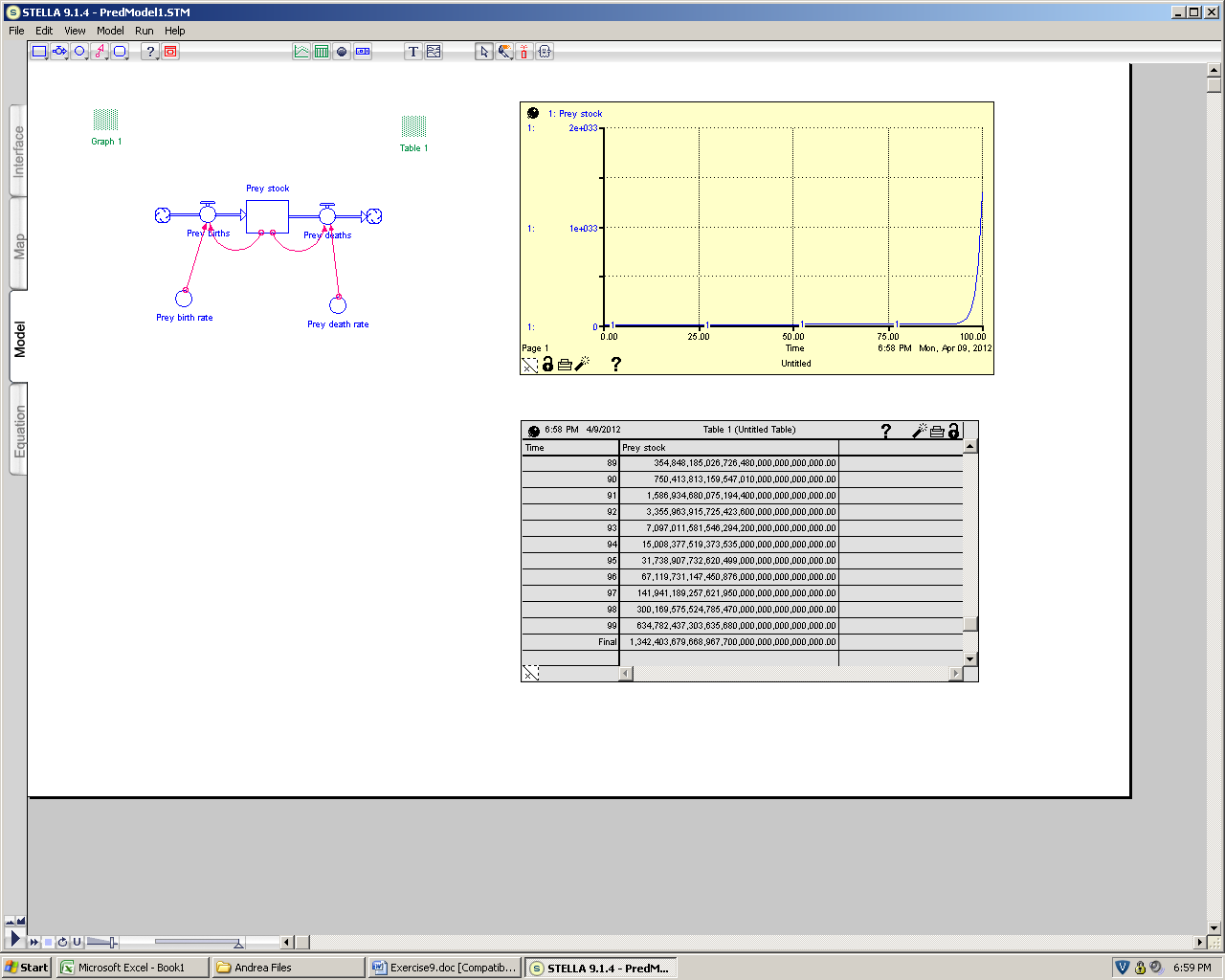
**Lab 9: Predation – Stella Models**

**PredModel1 - Prey exponential growth**

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**PredModel1 - Prey exponential growth - Equations**

Prey\_stock(t) = Prey\_stock(t - dt) + (Prey\_births - Prey\_deaths) \* dt

INIT Prey\_stock = 4

INFLOWS:

Prey\_births = Prey\_birth\_rate\*Prey\_stock

OUTFLOWS:

Prey\_deaths = Prey\_death\_rate\*Prey\_stock

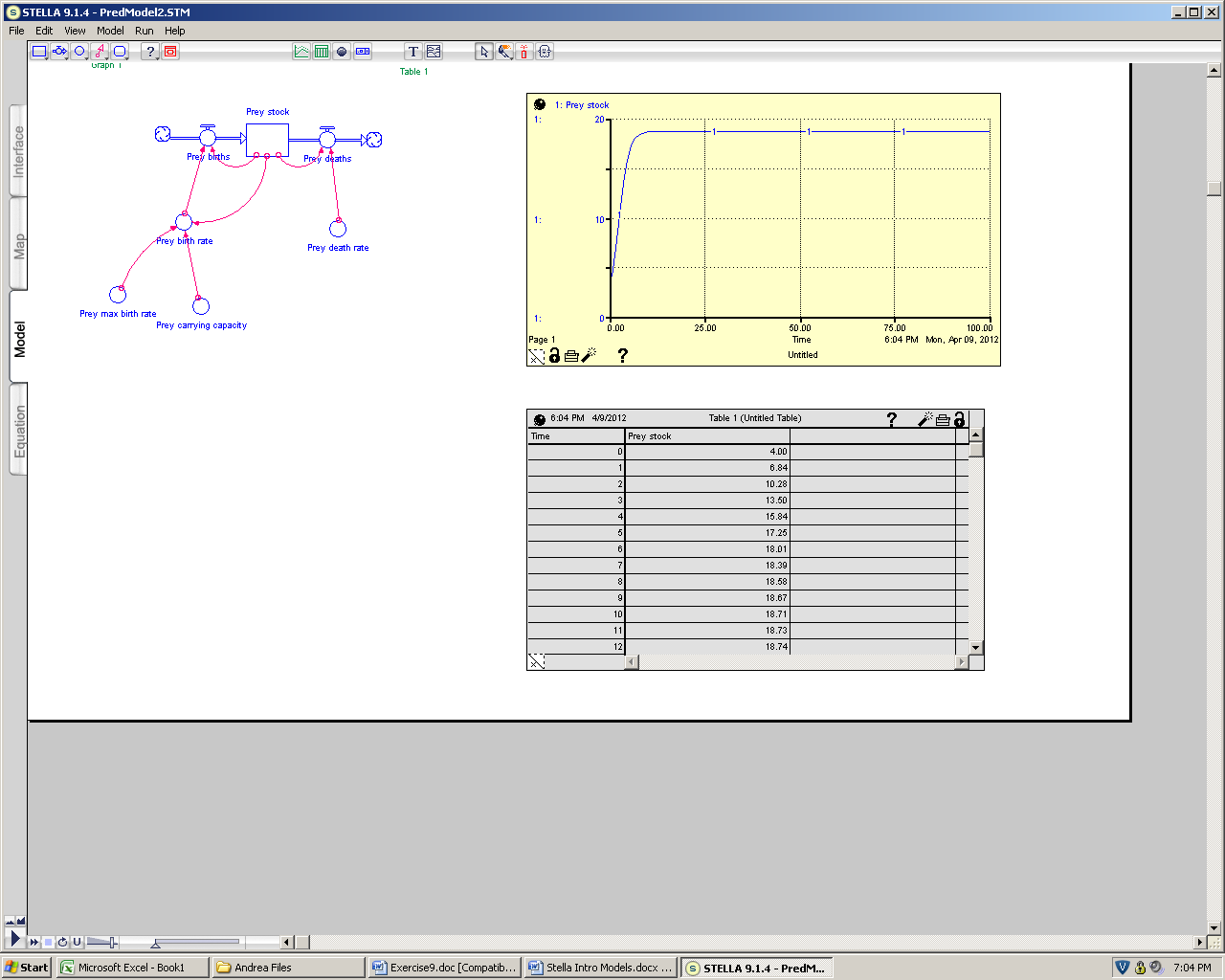
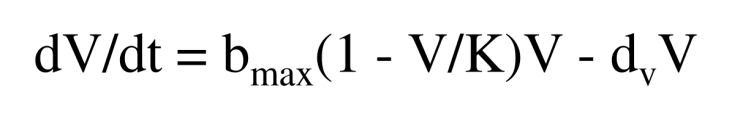
Prey\_birth\_rate = 0.8

Prey\_death\_rate = 0.05

**Notes:**

**Prey grow exponentially**

**PredModel2 - Prey density dependent growth**



**PredModel2 - Prey density dependent growth - Equations**

Prey\_stock(t) = Prey\_stock(t - dt) + (Prey\_births - Prey\_deaths) \* dt

INIT Prey\_stock = 4

INFLOWS:

Prey\_births = Prey\_birth\_rate\*Prey\_stock

OUTFLOWS:

Prey\_deaths = Prey\_death\_rate\*Prey\_stock

Prey\_birth\_rate = Prey\_max\_birth\_rate\*(1-(Prey\_stock/Prey\_carrying\_capacity))

Prey\_carrying\_capacity = 20

Prey\_death\_rate = 0.05

Prey\_max\_birth\_rate = 0.80

**Notes:**

**Prey grow to equilibrium abundance (V\*) in the absence of predation**

**IMPORTANT: V\* (=18.75) is not the same as carrying capacity (=20)!**

Start with:

Set equation equal to 0:

Move prey deaths to other side of equation:

Cancel V\*:

Distribute bmax:

Rearrange components:

Multiply both sides by K:

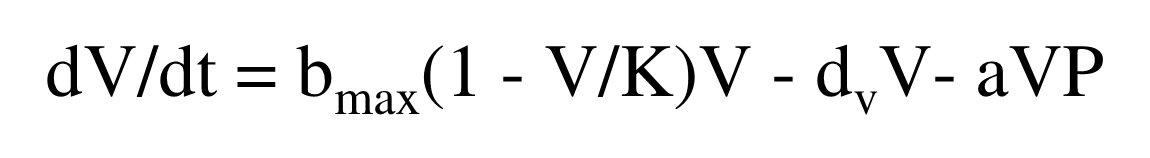
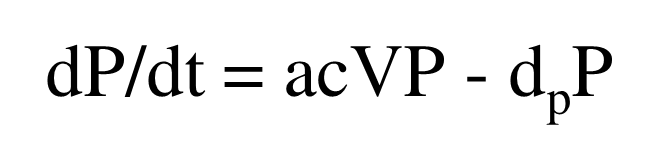
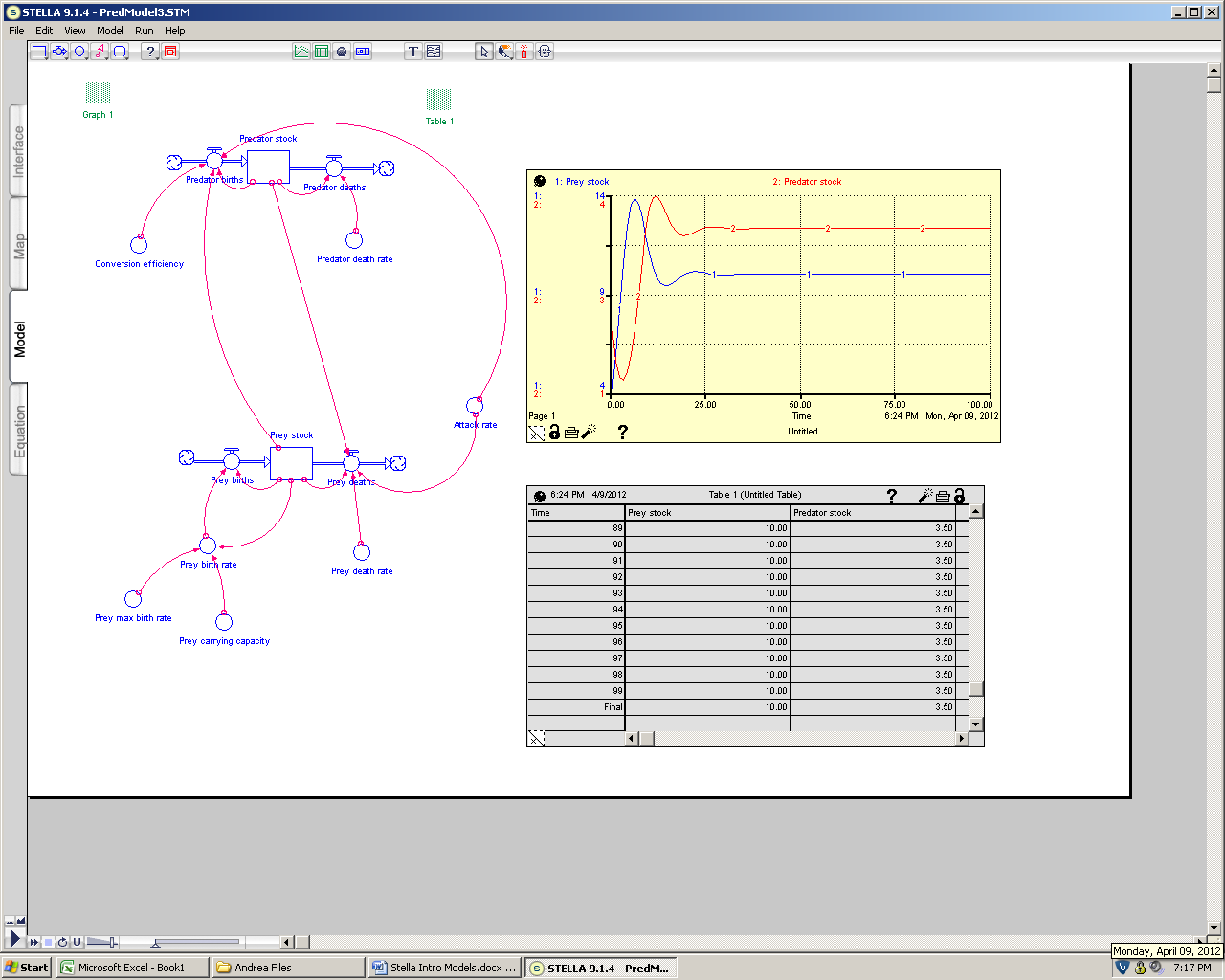
Divide both sides by bmax:

Result:

After simplifying:

**Plug in parameters:**

**PredModel3 - Prey density dependent growth with scramble predator**

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**PredModel3 - Prey density dependent growth with scramble predator - Equations**

Predator\_stock(t) = Predator\_stock(t - dt) + (Predator\_births - Predator\_deaths) \* dt

INIT Predator\_stock = 2

INFLOWS:

Predator\_births = Attack\_rate\*Conversion\_efficiency\*Prey\_stock\*Predator\_stock

OUTFLOWS:

Predator\_deaths = Predator\_death\_rate\*Predator\_stock

Prey\_stock(t) = Prey\_stock(t - dt) + (Prey\_births - Prey\_deaths) \* dt

INIT Prey\_stock = 4

INFLOWS:

Prey\_births = Prey\_birth\_rate\*Prey\_stock

OUTFLOWS:

Prey\_deaths = Prey\_death\_rate\*Prey\_stock+Attack\_rate\*Prey\_stock\*Predator\_stock

Attack\_rate = 0.1

Conversion\_efficiency = 0.6

Predator\_death\_rate = 0.6

Prey\_birth\_rate = Prey\_max\_birth\_rate\*(1-(Prey\_stock/Prey\_carrying\_capacity))

Prey\_carrying\_capacity = 20

Prey\_death\_rate = 0.05

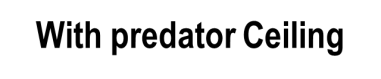
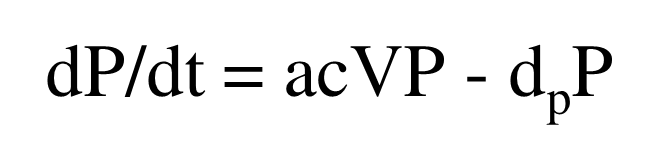
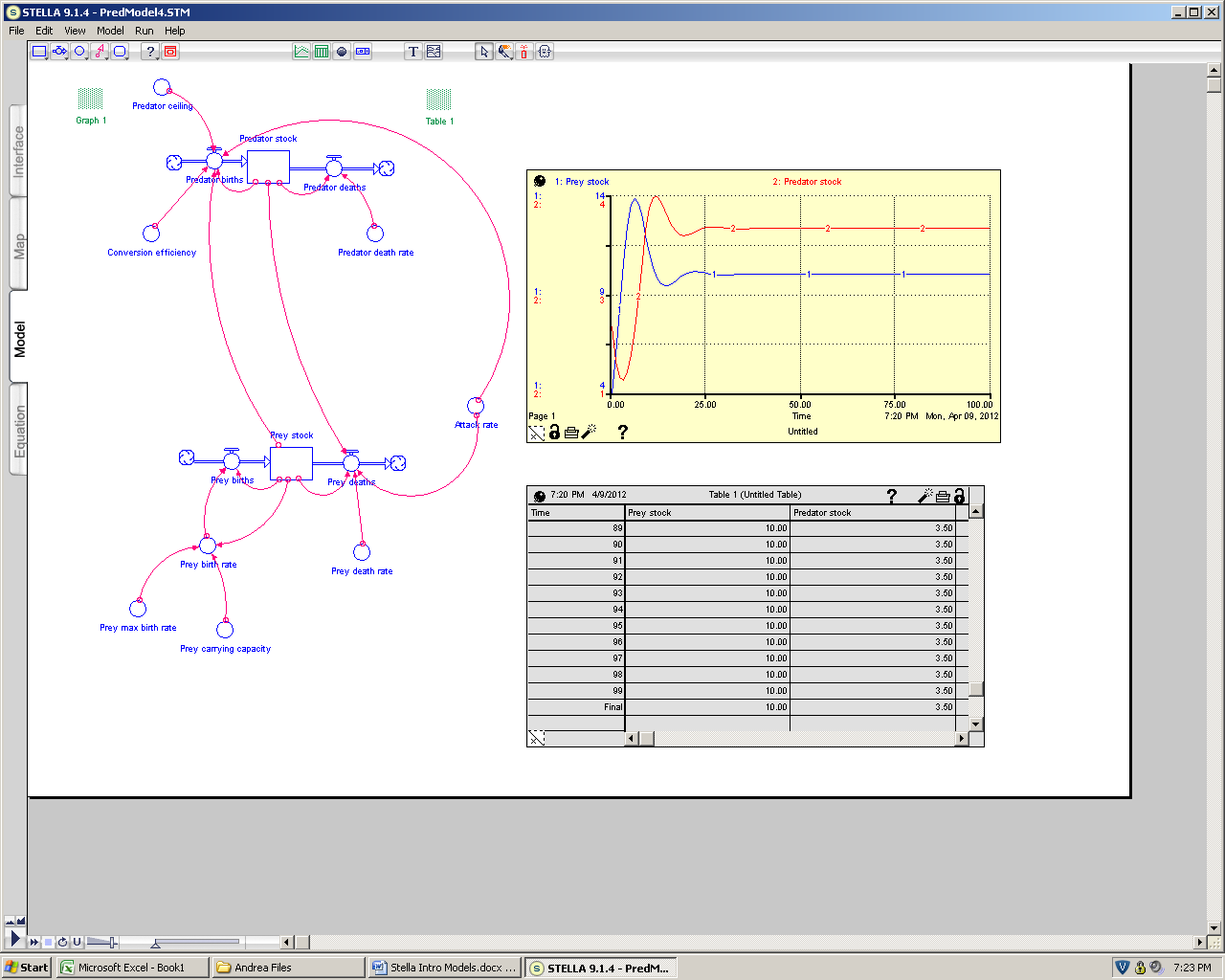
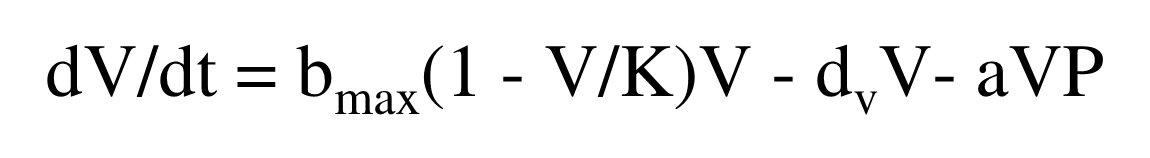
Prey\_max\_birth\_rate = 0.80

**Notes:**

**Prey and predators grow to equilibrium abundances (V\* and P\*)**

**See Part A of Lab 9 for calculations**

**PredModel4 - Prey density dependent growth with contest predator**

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**PredModel4 - Prey density dependent growth with contest predator**

Predator\_stock(t) = Predator\_stock(t - dt) + (Predator\_births - Predator\_deaths) \* dt

INIT Predator\_stock = 2

INFLOWS:

Predator\_births = IF(Predator\_stock<Predator\_ceiling) THEN (Attack\_rate\*Conversion\_efficiency\*Prey\_stock\*Predator\_stock) ELSE (0)

OUTFLOWS:

Predator\_deaths = Predator\_death\_rate\*Predator\_stock

Prey\_stock(t) = Prey\_stock(t - dt) + (Prey\_births - Prey\_deaths) \* dt

INIT Prey\_stock = 4

INFLOWS:

Prey\_births = Prey\_birth\_rate\*Prey\_stock

OUTFLOWS:

Prey\_deaths = Prey\_death\_rate\*Prey\_stock+Attack\_rate\*Prey\_stock\*Predator\_stock

Attack\_rate = 0.1

Conversion\_efficiency = 0.6

Predator\_ceiling = 5

Predator\_death\_rate = 0.6

Prey\_birth\_rate = Prey\_max\_birth\_rate\*(1-(Prey\_stock/Prey\_carrying\_capacity))

Prey\_carrying\_capacity = 20

Prey\_death\_rate = 0.05

Prey\_max\_birth\_rate = 0.80

**Notes:**

**Prey and predators grow to equilibrium abundances (V\* and P\*)**

**See Part A of Lab 9 for calculations**

**Note: With prey carrying capacity = 20, predators equilibrium abundance (=3.5) is less than predator ceiling**