OMG MIDTERM 2 IS ON MONDAY!!!!11

- It is cumulative! The horror!
- Bring the same stuff as last time.
- Same spiel as last time—"know everything."
- Don't be your own worst enemy. Be honest with yourself about whether you truly understand something before moving on—just because you got a 10 on the homework doesn't necessarily mean you're prepared for the exam. And the exam is more important than the homework.
- Oh, and sorry about rushing through last discussion. I didn't like doing it either but it was unavoidable!

Part 1: Growth Stuff

Problem 1. Match things.

a. economic growth
b. real GDP
c. average labor productivity
d. real GDP divided by the population
e. technological progress
f. human capital
g. diminishing returns

i. long-term increases in the aggregate level of output
ii. the index economists use to represent the aggregate level of
iii. the amount of output produced by one unit of labor, on average
iv. real GDP per capita
v. increase in know-how related to the production of goods and services
vi. knowledge and skills possessed by a person
vii. principle that additional capital or labor add less to output than previous ones.

Answer 1.

- **economic growth:** long-term increases in the aggregate level of output
- **real GDP:** the index economists use to represent the aggregate level of
- **average labor productivity:** the amount of output produced by one unit of labor, on average
- **real GDP divided by the population:** real GDP per capita
- **technological progress:** increase in know-how related to the production of goods and services
- **human capital:** knowledge and skills possessed by a person
- **diminishing returns:** principle that additional capital or labor add less to output than previous ones.

Problem 2. The real GDP in a year is $GDP1$, and the following year it is $GDP2$. What is the growth rate between these two years?

Answer 2. The growth rate is the percentage change in real GDP, calculated as

$$\%\Delta GDP = \frac{GDP2 - GDP1}{GDP1} \times 100.$$

Problem 3. Match more things.

a. knowledge capital

b. neoclassical theory

c. new growth theory

d. endogenous technological progress

i. total stock of knowledge possessed by the whole society

ii. growth theory in which technological progress is exogenous

iii. growth theory in which technological progress is endogenous

iv. technological progress that happens because of investments in research and development activities

Answer 3.

- **knowledge capital:** total stock of knowledge possessed by the whole society
- **neoclassical theory:** growth theory in which technological progress is exogenous—it is left unexplained and is simply taken as a given
- **new growth theory:** growth theory in which technological progress is endogenous—it is explained within the model itself
- **endogenous technological progress:** technological progress that happens because of investments in research and development activities. This is the main feature of new growth theory. These models explain why technological progress takes place—in particular, because firms spend money on research and development.

Problem 4. *True or False.* One way to increase labor productivity is to increase the amount of capital per worker.

Answer 4: True. Labor productivity is output per worker. If you give everyone more capital with which to work (e.g. more tools per worker), then those same people will produce more output and therefore will be more productive.

Problem 5. *True or False.* One way to increase capital per worker is to encourage saving by households.

Answer 5: True. When households save more money, that money becomes loanable funds. This amounts to an increase in the supply of loanable funds, which reduces the real interest rate. This means firms are willing to invest more, and therefore more capital will be accumulated with time.

Problem 6. In a country, the labor force participation rate is 75%, the employment rate is 90%, and the average labor productivity is 40,000 units of output. In this country, the output per capita equals what?

Answer 6. The relevant formulas are:

$$\text{labor force participation rate: } \frac{\text{Labor Force}}{\text{Civilian Population}}$$

$$\text{employment rate: } \frac{\text{Employment}}{\text{Labor Force}}$$

$$\text{average labor productivity: } \frac{\text{Output}}{\text{Employment}}$$

$$\text{output per capita: } \frac{\text{Output}}{\text{Civilian Population}}$$

It follows that

$$\begin{aligned}\frac{\text{Output}}{\text{Civilian Population}} &= \frac{\text{Output}}{\text{Employment}} \times \frac{\text{Employment}}{\text{Labor Force}} \times \frac{\text{Labor Force}}{\text{Civilian Population}} \\ &= 40,000 \times 0.90 \times 0.75 \\ &= 27,000 \text{ output per civilian.}\end{aligned}$$

Problem 7.

population:	$100,000,000$
labor force:	$80,000,000$
employed:	$60,000,000$
real GDP:	$2,400,000,000,000$

Find the following:

(a) labor force participation rate

(b) employment rate

(c) average labor productivity

(d) real GDP per capita

Answer 7.

(a) Labor force participation rate is

$$\frac{80,000,000}{100,000,000} = 80\%.$$

(b) Employment rate is

$$\frac{60,000,000}{80,000,000} = 75\%.$$

(c) Average labor productivity is real GDP divided by workers:

$$\frac{2,400,000,000,000}{60,000,000} = 40,000.$$

(d) Real GDP per capita GDP divided by the population:

$$\frac{2,400,000,000,000}{100,000,000} = 24,000.$$

Physical and human capital are

- **rivalrous.** Its use by one agent prevents another agent from simultaneously using it.

  If a farmer A is currently using this tractor, then farmer B cannot also use the same tractor.

  A scientist can work on my project or your project, but not on both at the same time.

- **subject to diminishing returns.** Every additional unit generates less new output than did the previous unit.

  Adding another tractor will make the farmer more productive, but not as much as the first tractor did.

  Adding another scientist will make your project move more quickly, but it won't speed things up as much as adding the first scientist did.

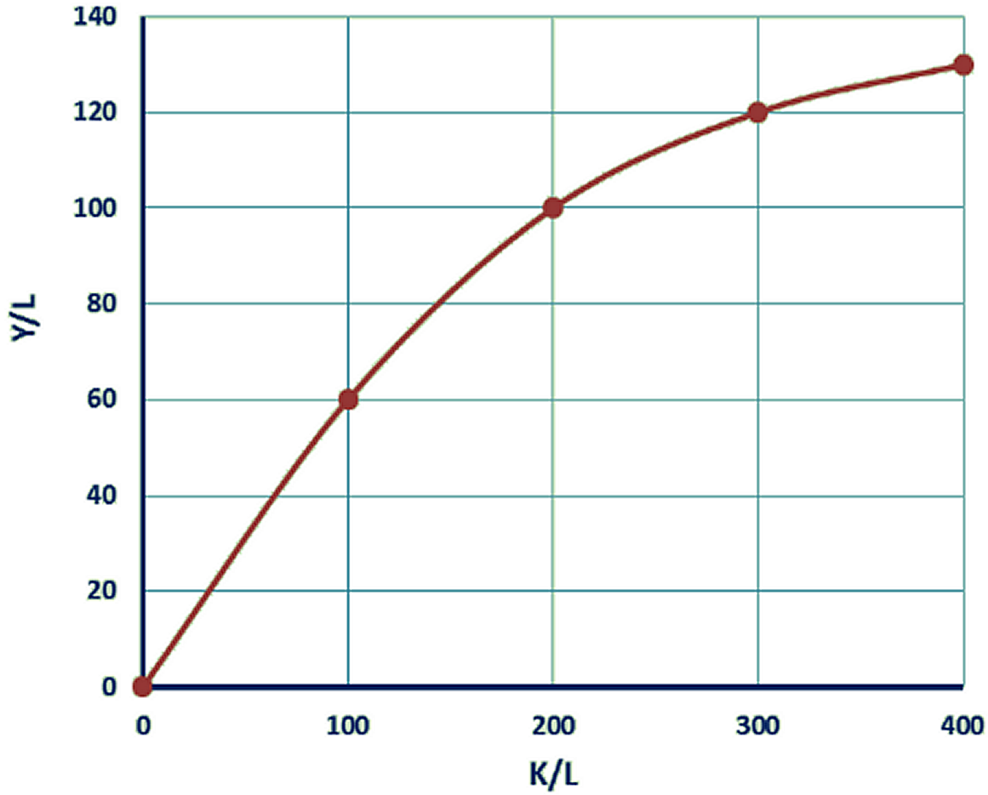
Knowledge capital is

- **non-rivalrous.** Me using one idea does not prevent you from using the very same idea.
- **not subject to diminishing returns.** Me using an idea doesn't make the same idea less useful to someone else.

Problem 8. Classical economic theory says that the per-worker production function should exhibit diminishing returns. What would a graph of this look like?

What does the graph look like according to the data? How can we explain this shape?

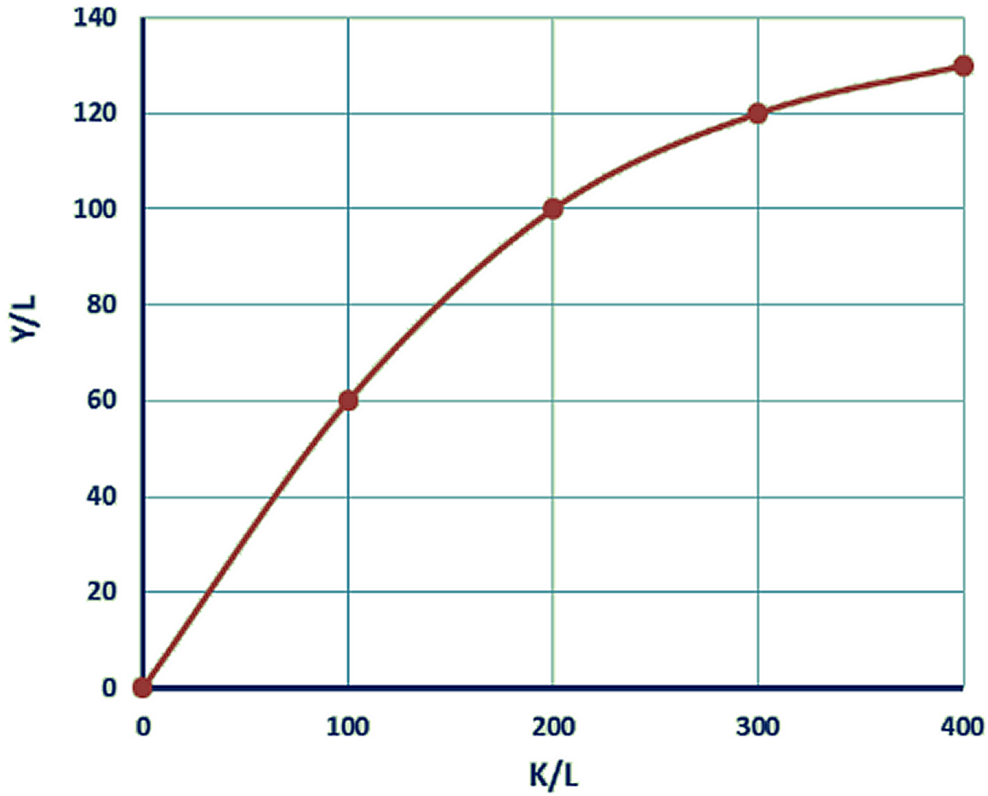
Answer 8.



This is the concave shape that theory suggests the per-worker production function should have.

However, the data shows a relatively straight line. According to new growth theory, there are no diminishing returns associated with knowledge capital at the national level. This is due to technological progress and the fact that knowledge capital is not subject to diminishing returns.

Problem 9.



LFPR:	50%
employment rate:	90%
physical capital K:	$300,000$
employed people L:	$1,500$

What is the average labor productivity? What is GDP per capita?

Answer 9. K/L is $300,000/1,500 = 200$. Therefore average labor productivity $Y/L = 100$.

GDP per capita can be decomposed as follows:

$$\begin{aligned}\frac{Y}{Population} &= \frac{Y}{L}\frac{L}{LF}\frac{LF}{Population} \\ &= 100 \times 0.90 \times 0.50 \\ &= 45.\end{aligned}$$

Problem 10. Which of the following are long-run factors of growth?

(a) capital accumulation

(b) technological progress

(c) population growth

(d) amount of natural resources

Answer 10. Factors of long-run economic growth

(a) capital accumulation—more machines, more production.

(b) technological progress—better machines, more production.

(c) population growth—more population, more workers, more production.

(d) amount of natural resources—more stuff, more machines, more production.

Governments can try to increase capital per worker by offering tax incentives to firms to invest more; or by giving people incentives to save more, which also results in more investment. Encouraging an efficient financial system has the same effect.

New growth theory economists argue that the fundamental cause of differences in growth rates and income levels is the differences in **economic institutions**.

- If you do not have proper protection of your private property, then you will not have much incentive to save in order to accumulate wealth.
- If the gov't can seize your home or factory without any cause, you won't be willing to invest.
- If you cannot reap the fruits of your inventions, you will not spend on research and development.

Part 2: Money Stuff

Problem 11. Match things again.

a. store of value

b. fiat money

c. medium of exchange

d. unit of account

e. commodity money

i. the function of money that refers to money's usefulness as an asset

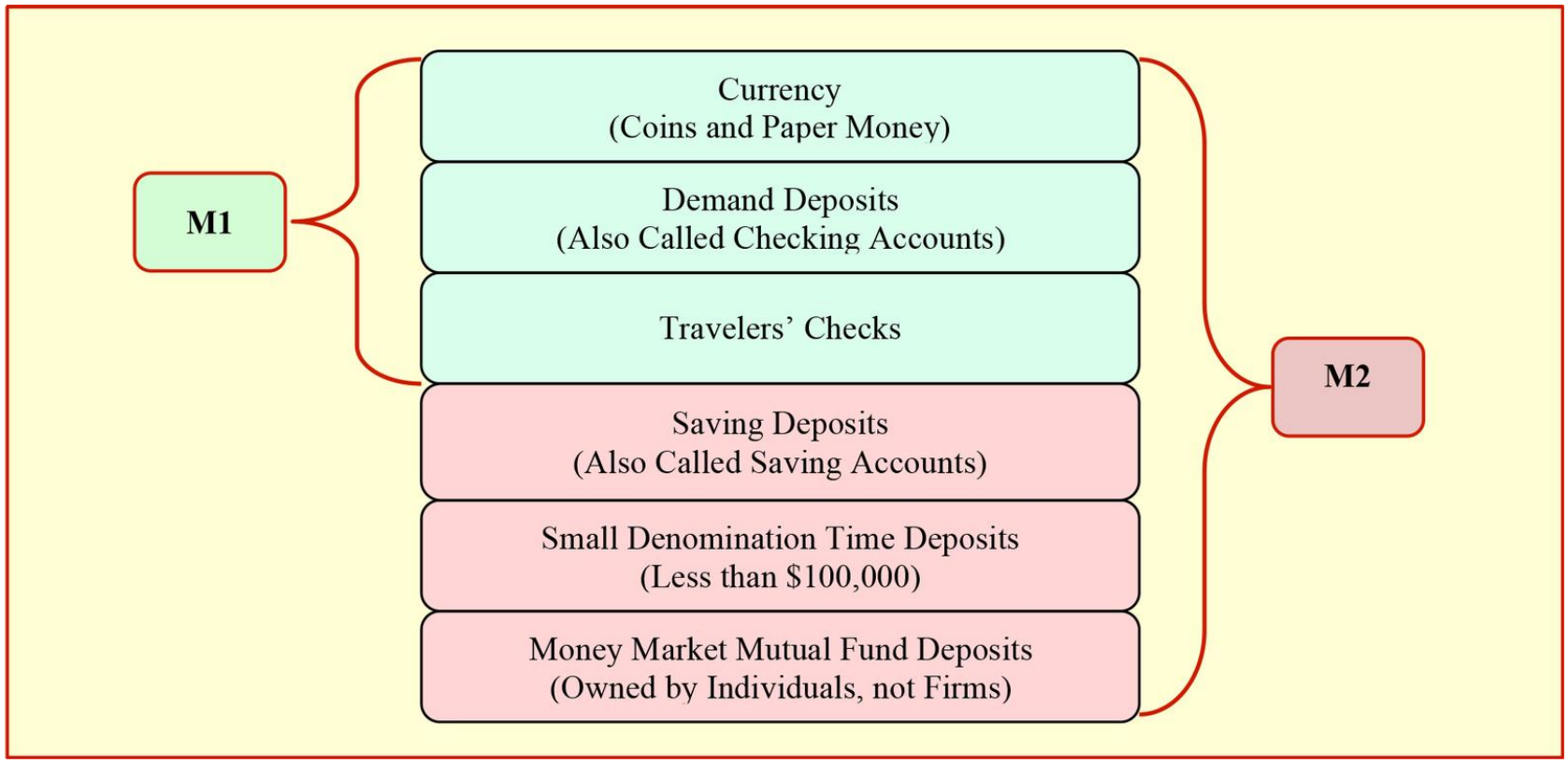
ii. type of money that has no intrinsic value, but is still used as a means of payment

iii. function of money that allows the avoidance of the double coincidence of wants problem associated with the barter system, i.e. facilitates transactions

iv. function of money that allows prices to be easily expressed according to a standard measure

v. type of money that has other uses besides serving as money, and thus has intrinsic value

Answer 11. I got lazy—they match in the order they're written. Note that there are two primary measures of money. **M1** consists of the most liquid forms of money. **M2** consists of slightly less liquid forms of money, in addition to everything in M1.



Problem 12. Abigail withdraws $100 from her savings account and deposits it in her checking account. As a result

(a) M1 remains unchanged, M2 decreases

(b) M1 remains unchanged, M2 increases

(c) M1 decreases, M2 remains unchanged

(d) M1 decreases, M2 decreases

(e) None of the above

Answer 12: e. The money in the savings account wasn't part of M1, but now that it's in a checking account it is part of M1. So M1 in increases. However, that money is part of M2 in either case, so M2 doesn't change.

Problem 13. Match even more! Do it!

a. discount loan

b. discount rate

c. required reserve ratio

d. open market operations

i. money banks borrow from the Fed

ii. the rate of interest charged on loans made by the Fed discount rate

iii. a fraction of deposits banks are required not to loan out required reserve ratio

iv. the Fed's purchases and sales of government bonds

Answer 13. I got lazy again—they match in the order they're written again.

Required Reserves. Here's how it works. Suppose the required reserve ratio is 10%, and suppose people put $1000 into the bank as demand deposits. Then the bank must keep 10% of that $1000, i.e. $100. They can loan out the remaining $900.

Open Market Operations. If the Fed buys a bond from the public, then the public receives cash and the Fed receives a bond. This means that there is now money circulating in the economy that wasn't circulating before. *So an open market purchase increases the money supply.* This is the Federal Reserve's primary tool for controlling the money supply.

If the Fed sells a bond to the public, then the Fed gives the public a bond but takes away the cash. Now there's less money circulationg in the economy. *So an open market sale decreases the money supply.*

Problem 14. Match match match match? Match match match match.

a. balance sheet

b. required reserves

c. excess reserves

d. fully loaned out

i. statement of assets, liabilities, and net worth

ii. minimum amount of cash that banks must hold at all times

iii. the amount of cash that banks might hold in excess of what is required by the Fed

iv. banks are said to be this when they have no excess reserves

Answer 14. Hey guess what, they're in the same order again.

Consider the example from before. Suppose the required reserve ratio is 10%, and suppose people put \$1000 into the bank as demand deposits. Then the bank must keep 10% of that \$1000, i.e. \$100. They can loan out the remaining \$900.

If the bank does loan out that entire \$900 that they're allowed to loan out, then they are **fully loaned out.** If they only lend out \$800 of it, then they have \$100 in **excess reserves**.

Problem 15. The required reserve ratio is 10%. Assume that the bank is fully loaned out. What is the bank's net worth?

Assets		Liabilities and Net Worth	
Reserves	?	Deposits	300,000,000
Treasury Bonds	5,000,000	Borrowing	15,000,000
Loans	350,000,000	Net Worth	?

Answer 15. The bank has deposits of 300,000,000. They're required to hold onto 10% of of it, i.e. 30,000,000. We're told that the bank is fully loaned out, so we can conclude that they hold reserves of 30,000,000. Then the net worth is calculated as

$$\begin{aligned}\text{net worth} &= \text{assets} - \text{liabilities} \\ &= (30,000,000 + 5,000,000 + 350,000,000) - (300,000,000 + 15,000,000) \\ &= 70,000,000.\end{aligned}$$

Assets		Liabilities and Net Worth	
Reserves	30,000,000	Deposits	300,000,000
Treasury Bonds	5,000,000	Borrowing	15,000,000
Loans	350,000,000	Net Worth	70,000,000

Problem 16. Suppose the Fed purchases $100 worth of Treasury bonds. Suppose also that the required reserve ratio is 10%. How much deposits will be created in the banking system?

Answer 16. The money multiplier equation is

$$\$100 \times \frac{1}{0.10} = \$100 \times 10 = \$1000.$$

So, if the banks decide to lend out everything they can—i.e. to hold no excess reserves—then \$1000 will be created in the banking system. If the banks choose to hold on to excess reserves, then less than \$1000 will be created.