TEST POLICIES (REMINDERS)

If you know that you will be absent on the day of a test, it may be possible to make arrangements with me to take the test on an earlier day. This alternative is not automatic!! Each case will be considered individually. You should notify me as soon as possible regarding planned absences. There are no make-up exams provided for unexpected absences. If you miss an exam for an unexpected absence, the average that you earn on the final will make-up the score for your missed exam. There are no exceptions – do not ask!!

HONOR POLICY: You must observe the following rules during any in class exam or quiz.

(1) Be prepared to move to a designated seat if requested. I will request that the class sit every other row if possible.
(2) You are not to leave the room without permission.
(3) You must not look anywhere in the room other than at your own test paper.
(4) You may not use or even touch a cell phone. Remember your cell phone is to be silenced in class.
(5) You may not speak to another student.
(6) You may not share materials with another student.
(7) Have all your materials ready. You may not retrieve items from your backpack etc.

Failure to observe all of the policies will result in a zero score for the test or quiz.

When you complete the test, hand it to me personally. You may leave the room at this time. The only questions permitted during an exam are in reference to a misprint, omission, or illegible text. You are responsible for being prepared for the exam. Do not ask me how to do the problem, ask for a hint about how to do the problem, or ask whether or not your answer is correct. Please do not share (at this time) your misery of being absent for a particular topic, that you forgot how to do the problem, or that you do not have enough time. You will not have the time to figure out problems on exam day. You are to come prepared, polished, and ready to complete the exam. You must turn in your test paper when time is called. I will give a five minute warning before collecting exams. If you do not hand in your paper at that time, I will not accept it later. It is your responsibility to keep track of time during the exam.

TEST REVIEW PROBLEMS

This test review will give you an idea of the difficulty level of the problems that will be on the exam. This test review contains a sample problem from every topic that will be covered on the exam. Test problems will be similar, but not identical. if you have done all the homework, asked for help as needed, and reviewed the material diligently, you should now find this review easy to moderate to complete. If you struggle with the review, we will go over some solutions in class. However, please be aware that your struggle is an indication that you should go back to the homework sets and work additional problems similar to those on this review in order to perform well on the exam.

The problems begin on the next page. The answers are included at the end of the review.

**** Also review group work exercises, quizzes, and class examples. ****

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1. A bulldozer was purchased by a construction company for $224,000 and is assumed to have a depreciated value of $100,000 after 8 years. Supposing the bulldozer depreciates linearly,

   A. Find the linear equation that relates V (in dollars) to time t (in years).
   B. What would be the value of the bulldozer after 12 years?
   C. After how many years would the bulldozer have no value?
   D. Interpret the slope of the linear equation.

2. The distance d between a fixed spring and floor is a linear function of the weight w attached to the bottom of the spring. The bottom of the spring is 18 inches from the floor when the weight attached is 3 pounds and 10 inches from the floor when the weight attached is 5 pounds.

   A. Find a linear equation that expresses d in terms of w.
   B. Interpret the slope of your linear equation.
   C. Find the distance from the bottom of the spring to the floor if no weight is attached.
   D. Find the smallest weight that will make the bottom of the spring touch the floor. (ignore the height of the attached weight.)

3. On January 1, 2004, a college student makes a $5,000 deposit in a checking account. The account is steadily decreasing each by $200 at the end of each month.

   A. Write a linear equation where y is the amount in the student's checking account, in terms of x, where x is the number of months after January 1, 2004.
   B. Identify the slope AND EXPLAIN what it represents in terms of how much money is in the account.
   C. In how many months will the student have only $1,400 in the account?

4. When the price of rice is $2 per bushel, the demand is 10 million bushels. When the price is $3 per bushel, the demand is 8 million bushels. Use this data to find a linear demand function for rice (in millions of bushels).

5. Let the demand and supply functions be represented by D(p) and S(p), where p is the price in dollars. Find the equilibrium price and demand (supply) for the given functions.

   $D(p) = 5060 - 90p$ and $S(p) = 130p$

6. Given the supply and demand functions below, find the price when the demand is 145. Is there a surplus or shortage at this price?

   $S(p) = 9p + 12$ and $D(p) = 280 - 9p$

7. Let the demand and supply functions be represented by D(p) and S(p), where p is the price in dollars. For what prices is there a shortage?

   $D(p) = 4000 - 90p$ and $S(p) = 110p$

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8. The weekly demand for shampoo in a chain of drug stores is 1,480 bottles at a price of \$8.79 per bottle. If the price is lowered to \$7.89, the weekly demand increases to 2,200. Assume that the relationship between demand D and price per p is linear.

   A. Write a linear equation that expresses D in terms of p.
   B. What should the price of a bottle of shampoo be so that the demand is 3700 bottles?
   C. How many bottles would the stores sell each week if the price is raised to \$9.75?
   D. Suppose that the Supply function for the mouthwash is S = 400p. Is there a surplus or shortage when the price is \$9.75? Explain.
   E. Find the equilibrium price.
   F. For what prices is there a shortage? Explain.

9. The weekly demand for toothpaste in a chain of drug stores is 3,500 tubes at a price of \$2.79 per tube. If the price is lowered to \$1.59, the weekly demand increases to 3,860. Assume that the relationship between demand D and price per p is linear.

   A. Write a linear equation that expresses D in terms of p.
   B. What should the price of a tube of toothpaste be so that the demand is 4000 tubes?
   C. How many tubes would the stores sell each week if the price were lowered to \$1.29?
   D. Suppose that the Supply function for the mouthwash is S = 1400p. Is there a surplus or shortage when the price is \$1.29? Explain.
   E. Find the equilibrium price.
   F. For what prices is there a shortage? Explain.

10. The financial department of a company that produces digital cameras arrived at the following price-demand function and cost function:

    price-demand: $p(x) = 95.4 - 6x$

    cost: $C(x) = 150 + 15.1x$ (in million dollars)

    The function p(x) is the wholesale price per camera at which x million cameras can be sold and C(x) is the cost function (in million dollars) of producing and selling x million cameras. Both functions have domain $1 \leq x \leq 15$.

   A. Find and simplify the revenue function R(x) where x is the number of digital cameras sold (in millions) and R(x) is the revenue in millions of dollars.
   B. At what output is the revenue maximized? (Give units)
   C. What is the maximum revenue? (Give units)
   D. What the wholesale price at which the revenue is maximized? (Give units)
   E. At what output(s) does the company break-even? (Give units)
   F. If 10 million cameras are sold will the company make a profit or experience a loss? Explain.
   G. Find and simplify the profit function.
   H. Determine the approximate number of cameras that should be sold for maximum profit. (Give units)
   I. At what wholesale price the maximum profit occur? (Give units)
   J. What is the maximum profit?

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11. A company manufactures memory chips for microcomputers. Its marketing research department has determined that the price-demand, dollars, from the sale of x million chips is $p(x) = 80 - 2x$, $0 \leq x \leq 40$, and the cost, in millions of dollars, of making x million chips is $C(x) = 250 + 10x$.

    A. Find and simplify the revenue function R(x) where x is the number of microchips sold (in millions) and R(x) is the revenue in millions of dollars.
    B. At what output is the revenue maximized? (Give units)
    C. What is the maximum revenue? (Give units)
    D. What the wholesale price at which the revenue is maximized? (Give units)
    E. At what output(s) does the company break-even? (Give units)
    F. Find and simplify the profit function.
    G. Determine the approximate number of microchips that should be sold for maximum profit. (Give units)
    H. At what wholesale price the maximum profit occur? (Give units)

Simple Interest

12. How much will $15,400 be worth if it is invested at a simple interest rate of 16% for 5 years.

13. Find the pay-off amount of a loan of $540 with simple interest of 12% for 3 months.

Finding initial deposit amount

14. What principle must be deposited to accumulate $1554.30 at 6% interest, compounded quarterly for 3 years?

15. Barbara knows that she will need to buy a new car in 3 years. The car will cost $15,000 by then. How much should she invest now at 6%, compounded quarterly, so that she will have enough to buy a new car?

16. Southwest Dry Cleaners believes that it will need new equipment in 10 years. The equipment will cost $26,000. What lump sum should be invested today at 6% compounded semiannually, to yield $26,000?

Finding length of investment or loan

17. How many years will be required to turn $24,000 into $30,402.01 if the interest rate is 12% compounded quarterly?

18. Anne purchased a bond for a museum valued at $8000 for $2400. If the bond pays 5.5% annual interest compounded monthly, how long must she hold it until it reaches its full face value?

Finding interest rate

19. What interest rate compounded monthly is needed to have a $1,000 investment grow to $3,000 in five years?

20. If Jay bought a lot for $8,000 and sold it 10 years later for $ 24,000, what was her percentage rate of return on this investment if it was compounded annually?

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Finding final investment accumulation

21. If you deposit $350 a month into your child's college fund for 18 years at 5.7% compounded monthly, how much will you accumulate?

22. If $ 3500 is invested at the rate of 8%, compounded quarterly, what will be the value of the investment 17 years from now, assuming no withdrawals?

23. $765.13 is deposited at the end of each month for 2 years in an account paying 12% interest compounded monthly. Find the amount of the account.

24. How much will $ 20,000 be worth if it is invested at 9% interest, compounded semi-annually for 14 years.

Finding payment value (investment or loan payment)

25. Larry wants to start an IRA that will have $ 660,000 in it when he retires in 29 years. How much should he invest semiannually in his IRA to do this if the interest is 13% compounded semiannually? How much total interest will be earned through this investment?

26. How much will you need to save each month (for 30 years) to accumulate $2,000,000 in your retirement account if you can earn 8% compounded monthly? How much is the balance at the beginning of the 29^{th} year? How much interest will be earned in the last year of this investment?

27. In order to purchase a home, a family borrows $ 60,000 at 13% compounded monthly for 30 years. What is their monthly payment? What is the unpaid balance after one year of payments have been made? How much in interest is paid during the first year of this mortgage? What is the unpaid balance after 29 years of payments have been made? How much interest will the family pay in the last year of the mortgage?

28. You purchase a home set up a 30-year mortgage $320,000 with a loan company that charges 6.5% compounded monthly. What will your monthly mortgage payments be? How much in interest will you pay over this mortgage?

SOLUTIONS:

1. A. Find the slope (-15,500) of the linear equation using the two given ordered pairs: (0, 224,000) and (8, 100,000). The y-intercept is given as 224,000. Thus, the equation is $V(t) = V = -15{,}500\,t + 224{,}000$
   B. $V(12) = -15{,}500(12) + 224{,}000 = \$38{,}000$
   C. Solve $V(t) = -15{,}500\,t + 224{,}000 = 0 \Rightarrow t \sim 14$ years
   D. Each year the value of the bulldozer decreases by $15,500.

2. A. Find the slope (-4) of the linear equation using the two given ordered pairs: (3, 18) and (5, 10). Thus far, we have $d = -4\,w + b$. Using one of the ordered pairs and substitution: $18 = -4(3) + b$ gives $b = 30$. The equation is $d = -4\,w + 30$.
   B. For each additional lb. increase in the attached weight the distance from the spring and the floor decreases by 4 inches.

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2. C. d = -4(0) + 30 = 30 inches
   D. Solve d = -4 w + 30 = 30 fives w = 7.5 lbs.

3. A. The slope is given as -200 from the statement that the student withdraws $200 each month. The y-intercept is given by the statement that the account initially contains $5,000. Thus, the equation is y = -200 x + 5000
   B. -200, each month the student withdraws $200.
   C. Solve y = -200 x + 5000 = 1400 ➔ x = 18 months

4. (2, 10) and (3, 8) are the ordered pairs that have been given. The slope of the demand function is (8 – 10)/((3 – 2) = -2/1 = -2. D = -2p + b, substitute (2, 10) into the equation and solving for b, gives 10 = -2(2) + b ➔ 10 = -4 + b ➔ b = 14.
D(p) = -2p + 14.

5. 5060 - 90p = 130p ➔ 5060 = 220p ➔ p = 5060/220 = 23. Supply will equal demand when the price is $23.

6. 145 = 280 – 9p = D(p) ➔ -9p = -135 ➔ p = $15
S(15) = 9(15) + 12 = 147. The supply (147) exceeds the demand (145), so there is a surplus.

7. The equilibrium price is found by solving 4000 - 90p = 110p ➔ 4000 = 200p ➔ p = 20. When the price is $20, supply equal demand. A shortage occurs when supply < demand. Since the demand function is a decreasing function, there are more products demanded when the price < $20, than for prices $\geq$ $20. Meanwhile, since the supply function is an increasing function, there are less products supplied when the price < $20, than for prices $\geq$ $20. In summary, for p < $20, demand > supply; p = $20, demand = supply; and p > $20, demand < supply. Thus, a shortage occurs when p < $20.

8. A. (8.79, 1480) and (7.89, 2200) ➔ D = -800p + 8512
   B. Solve 3700 = -800p + 8512 for p, p = $6.02
   C. Demand = -800(9.75) + 8512 = 712 bottles
   D. S= 400(9.75) = 3900 bottles. There is a surplus, since S = 3900 > D =712
   E. 400p = -800p + 8512 ➔ p = $7.09
   F. For p < $7.09, Supply is less than demand

9. A. (2.79, 3500) and (1.59, 3860) ➔ D = -300p + 4337
   B. Solve 4000 = -300p + 4337 for p, p = $1.12
   C. Demand = -300(1.29) + 4337 = 3950 tubes
   D. S= 1400(1.29) = 1806 bottles. There is a shortage, since S = 1806 < D = 3950
   E. 1400p = -300p + 4337 ➔ p = $2.55
   F. For p < $2.55, Supply is less than demand

10. A. R(x) = xp(x) = x(95.4 – 6x) = $-6x^2 + 95.4x$
    B. x = -b/2a = -95.4/(2*-6) = 7.93 million cameras
    C. R(7.93) = 379.21 million dollars
    A graph can be used to solve parts B & C.

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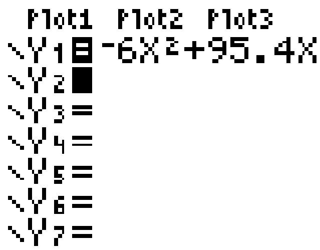
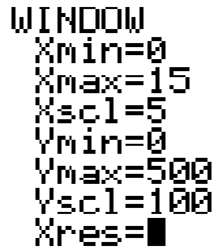
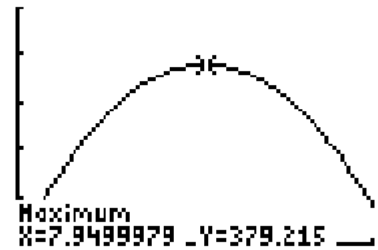
10. B & C graphically

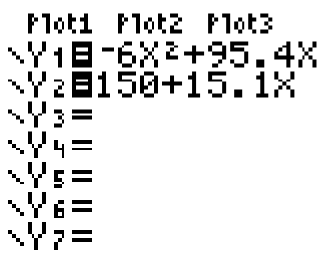


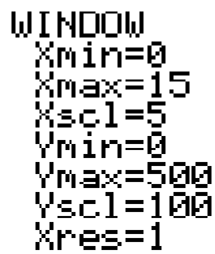


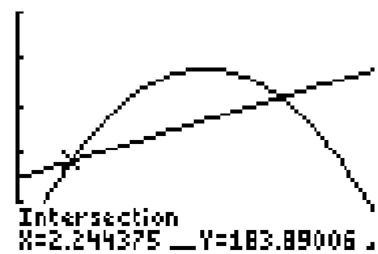


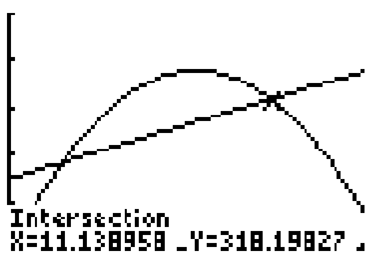
D. p(7.93) = 95.4 – 6(7.93) = \$47.82 per camera

E. Find x so that R(x) = C(x). x= 2.24 and 11.14 million cameras
Solve part E using a graph.









F. Profit x = 10 lies between the two break-even points, 2.2 < 10 < 11.13.

G. $P(x) = -6x^2 + 95.4x - (150 + 15.1x) = -6x^2 + 80.3x - 150$

H. x = -b/2a = -80.3/(2*-6) = 6.69 million cameras
Part H can be solved in the same manner as part B.

I. p(6.69) = 95.4 – 6(6.69) = \$55.26 per camera

J. $P(6.69) = -6(6.69)^2 + 80.3(6.69) - 150 = 118.67$ million dollars

11. Note: The solution method for #11 is the same as for #10.

A. $R(x) = x(80 - 2x) = -2x^2 + 80x$

B. x = -b/2a = -80/(2*-2) = 20 million chips

C. $R(20) = -2(20)^2 + 80(20) = 800$ million chips

D. p(x) = 80 – 2x ➔ p(20) = 80 – 2(20) = \$40 dollars per chip

E. x = 4.04 and 30.96 million chips

F. $P(x) = -2x^2 + 80x - (250 + 10x) = -2x^2 + 70x - 250$

G. x = -b/2a = -70/(2*-2) = 17.5 million chips

H. p(x) = 80 – 2x ➔ p(17.5) = 80 – 2(17.5) = \$45 dollars per chip

12. A = P(1 + rt) = 15400(1 + .16*5) = \$27,720

13. A = P(1 + rt) = 540(1 + .12(3/12)) = \$556.20

****

14. $1300.00

```
 N=12
 I%=6
▪PV=-1299.99697
 PMT=0
 FV=1554.3
 P/Y=4
 C/Y=4
 PMT:END BEGIN
```

15. $12,545.81

```
 N=12
 I%=6
▪PV=-12545.81133
 PMT=0
 FV=15000
 P/Y=4
 C/Y=4
 PMT:[redacted] BEGIN
```

16. $14,395.57

```
 N=20
 I%=6
▪PV=-14395.56961
 PMT=0
 FV=26000
 P/Y=2
 C/Y=2
 PMT:[redacted] BEGIN
```

17. 8 quarters = 2 years

```
▪N=7.999474822
 I%=12
 PV=-24000
 PMT=0
 FV=30402.01
 P/Y=4
 C/Y=4
 PMT:[redacted] BEGIN
```

18. 263.3 months = 21.94 years

```
▪N=263.2865031
 I%=5.5
 PV=-2400
 PMT=0
 FV=8000
 P/Y=12
 C/Y=12
 PMT:[redacted] BEGIN
```

19. 22.17%

```
 N=60
▪I%=22.17463732
 PV=-1000
 PMT=0
 FV=3000
 P/Y=12
 C/Y=12
 PMT:[redacted] BEGIN
```

20. 11.6123%

```
 N=10
▪I%=11.6123174
 PV=-8000
 PMT=0
 FV=24000
 P/Y=1
 C/Y=1
 PMT:[redacted] BEGIN
```

21. $131,387.45

```
 N=216
 I%=5.7
 PV=0
 PMT=-350
▪FV=131387.4487
 P/Y=12
 C/Y=12
 PMT:END BEGIN
```

22. $13,454.88

```
 N=68
 I%=8
 PV=-3500
 PMT=0
▪FV=13454.87676
 P/Y=4
 C/Y=4
 PMT:END BEGIN
```

23. $20,638.21

```
 N=24
 I%=12
 PV=0
 PMT=-765.13
▪FV=20638.20716
 P/Y=12
 C/Y=12
 PMT:END BEGIN
```

****

24. $68,594.00

```
N=28
I%=9
PV=-20000
PMT=0
■FV=68593.99985
P/Y=2
C/Y=2
PMT:END BEGIN
```

25. $1141.79

```
N=58
I%=13
PV=0
■PMT=-1141.7939…
FV=660000
P/Y=2
C/Y=2
PMT:END BEGIN
```

Total paid in 58*1141.79 = 66,223.82.
Total amount in account less amount paid in: 660,000 – 66,223.82 = $593,776.18.

26. $1,341.96 Only 360 – 12 = 348 have been made in the first 29 years.

```
N=360
I%=8
PV=0
■PMT=-1341.9581…
FV=2000000
P/Y=12
C/Y=12
PMT:END BEGIN
```

```
N=348
I%=8
PV=0
PMT=-1341.9581…
■FV=1831296.051
P/Y=12
C/Y=12
PMT:END BEGIN
```

Total amount in account less balance at the beginning of the last year less amount paid into account in the last year is the total interest earned in the last year.
2,000,000 – 1,831,296.05 – 12(1341.96) = $152,600.43

27. $663.72 In 1 year only 12 payments are made. The bal. = $59, 825.19

```
N=360
I%=13
PV=60000
■PMT=-663.71971…
FV=0
P/Y=12
C/Y=12
PMT:END BEGIN
```

```
N=12
I%=13
PV=60000
PMT=-663.71971…
■FV=-59825.19085
P/Y=12
C/Y=12
PMT:END BEGIN
```

The total paid to the principle of the loan in the first year is 60,000 – 59,825.19 = $174.81.
The total in payments made is 12*663.72 = $7964.64.
The difference: 7964.64 – 174.81 = $7789.83 is the interest paid in the first year.

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27. In 29 years, 348 payments have been made. The balance is $7431.03

```
 N=348
 I%=13
 PV=60000
 PMT=-663.71971…
▪FV=-7431.033988
 P/Y=12
 C/Y=12
 PMT:END BEGIN
```

In the last year of the loan, the total paid is 12*663.72 = $7964.64. (This is the same amount paid every year. Their loan agreement is $663.72 a month.) The total amount of interest is the total paid 7964.64 less principle paid 7431.03 = $533.61.

28. $2022.62

```
 N=360
 I%=6.5
 PV=320000
▪PMT=-2022.6176…
 FV=0
 P/Y=12
 C/Y=12
 PMT:[redacted] BEGIN
```

360 payments of 2022.62 will be made. Subtract from the total payments, the total owed, that will give the total dollar amount in interest over the entire loan.
360(2022.62) – 320,000 = $408, 143.20