Test Name: homework1(Test)

1. It costs a toy retailer $10 to purchase a certain doll. He estimates that, if he charges dollars per doll, he can sell dolls per week. Find a function for his weekly profit.

**Answer:** F(x) = (x- 10) \* (80 – 2x) = -2x2 + 100x - 800

**2.**  Given the following function:

**Step 1.** Find .

**Answer:** 8 \* 33 + 7 \* 32 – 5 = 274

**Step 2.** Find .

**Answer:** 8 \* (-2)3 + 7 \* (-2)2 – 5 = - 41

**Step 3.** Find .

**Answer:** 8 \* 3 + 7 \* 2 – 5 = 8x3 + 24x2c + 24xc2 + 8c3 + 7x2 + 14xc + 7c2 -5

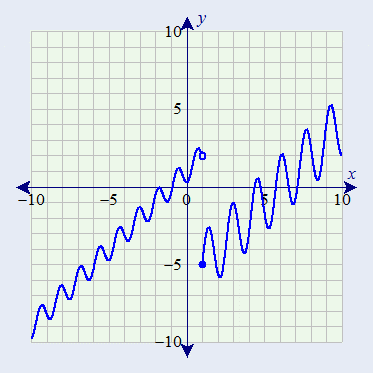
**3.**  Use the graph to find the indicated limits. If there is no limit, state "Does not exist".

**Step 1.** Find  
.

2

Does Not Exist

A)



Answer:

**Step 2.** Find  
.

**Answer: -5**

**Step 3.** Find  
.

**Answer: Does not exist**

**4.**  Find the derivative for the following function.

**Answer:**

**5.**  Find the derivative for the following function.

|  |
| --- |
| **Answer:** |
|  |
| |  | | --- | |  | |

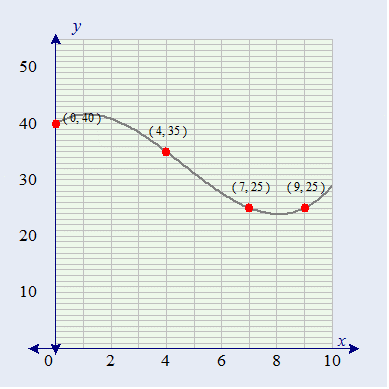
**6.**  Find the derivative for the following function.

**Answer:**

**7.**  Find the derivative for the following function.

**Answer:** -(2.25 \* x^(1/8))

**8.**  Consider the graph of . What is the average rate of change of from to ? Please write your answer as an integer or simplified fraction.



-5/4

Answer:

**9.**  The cost of producing *x* baskets is given by . Determine the average cost function.

**Answer:** (

**10.**  Use the Product Rule or Quotient Rule to find the derivative.

**Answer:** *f’(x)* = 4 \* ((9 - 5 \* x)/x^3) - 5 \* (1 - 2/x^2)

**11.**  Use the Product Rule or Quotient Rule to find the derivative.

**Answer:** Deriv((5\*x^.5+7)/(-x^3+1))

{

.e1 <- 1 - x^3

.e2 <- sqrt(x)

(2.5/.e2 + 3 \* (x^2 \* (5 \* .e2 + 7)/.e1))/.e1

}

**12.**  Find the derivative for the given function. Write your answer using positive and negative exponents and fractional exponents instead of radicals.

**Answer:** f’(x) = (4/3 \* (3 \* x^(-3) – 8\*x +6))^(1/3) \* (-9\*x^(-4) – 8)

**13.**  After a sewage spill, the level of pollution in Sootville is estimated by , where is the time in days since the spill occurred. How fast is the level changing after days? Round to the nearest whole number.

*f* = function(t) (550\*t^2)/sqrt(t^2+15)

Deriv(f)

function (t)

{

.e1 <- t^2

.e2 <- 15 + .e1

550 \* (t \* (2 - .e1/.e2)/sqrt(.e2))

}

When t = 3

.e1<-9

.e2<-24

550 \* (t \* (2 - .e1/.e2)/sqrt(.e2))

= 547

**Answer:** Level changing after 3 days is 547.

**14.**  The average home attendance per week at a Class AA baseball park varied according to the formula where *t* is the number of weeks into the season and *N* represents the number of people.

**Step 1.** What was the attendance during the third week into the season? Round your answer to the nearest whole number.

Nt = function(t)

Nt(3) = 2510

**Answer:** 2510

**Step 2.** Determine and interpret its meaning. Round your answer to the nearest whole number.

DNt = Deriv(Nt)

50/sqrt(0.1 \* x + 6)

DNt(5) = 20

**Answer:** 20. The attendance during the fifth weeks of the session.

**15.**  Consider the following function:

**Step 1.** Use implicit differentiation to find .

(3x^3 + 4y^3) = (77)

9x^2 + 12y^2y’ = 0

y’ = -

**Answer:** y’ = -

**Step 2.** Find the slope of the tangent line at .

**Answer:** solving for (3, -1), y’ = - 27/4

**16.**  Find the intervals on which the following function is increasing and on which it is decreasing.

**Answer:** there is no increasing, but decreasing (-∞, 8) and (8, ∞).

f<-function(x) (x+3)/(x-8)

s=seq(-10,10,by = .1)

a=f(s)

plot(a~s)

first<-Deriv(f)

first

**17.**  A frozen pizza is placed in the oven at . The function approximates the temperature (in degrees Fahrenheit) of the pizza at time .

**Step 1.** Determine the interval for which the temperature is increasing and the interval for which it is decreasing. Please express your answers as open intervals.

f<-function(t) 14+(367\*t^2)/(t^2+100)

s=seq(0,100, by=10)

a=f(s)

plot(a~s, type = "l", main="Solve for Max between 0 and 100")

first

**Answer:** the temperature is increasing at (0,∞), there is no interval exists for which it is decreasing.

**Step 2.** Over time, what temperature is the pizza approaching?

**Answer:** 381

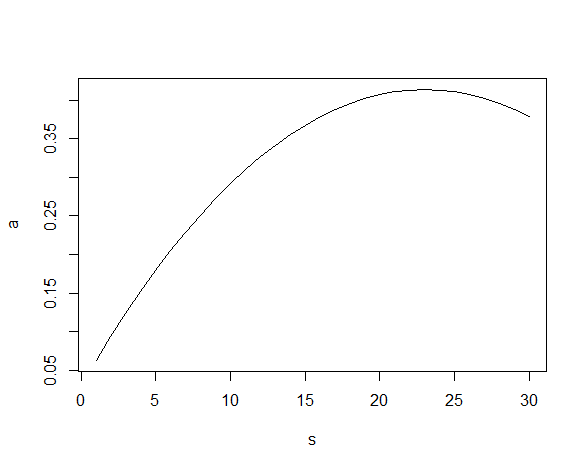
**18.**  A study says that the package flow in the East during the month of November follows , where is the day of the month and is in millions of packages. What is the maximum number of packages delivered in November? On which day are the most packages delivered? Round your final answer to the nearest hundredth.

f <- function(x) x^3/3340000-7\*x^2/9475+42417727\*x/1265860000+1/33

s=seq(1,30,by=1)

a=f(s)

plot(a~s,type = "|")



max(a)

[1] 0.4138353

min(a)

[1] 0.06307356

first=Deriv(f)

0.0335090191648366 + x \* (8.98203592814371e-07 \* x - 0.00147757255936675)

a=uniroot.all(first,c(1,30))

a

[1] 23.00001

**Answer:** The maximum number of packages is 0.41 million in day 23.

**19.**  Use the Second Derivative Test to find all local extrema, if the test applies. Otherwise, use the First Derivative Test. Write any local extrema as an ordered pair.

5

f<-function(x) 7\*x^2+28\*x-35

first<-Deriv(f)

first

function (x)

14 \* x + 28

second<-Deriv(first)

second

[1] 1

Use the First Derivative Test, f’(x) = 0, x = -2 is the only critical point, f(-2)= -63

**Answer:** the local minima is (-2, -63), there is no local maxima.

**20.**  Use the Second Derivative Test to find all local extrema, if the test applies. Otherwise, use the First Derivative Test. Write any local extrema as an ordered pair.

f<-function(x) -6\*x^3+27\*x^2+180\*x

first<-Deriv(f)

first

function (x)

180 + x \* (54 - 18 \* x)

second<-Deriv(first)

second

function (x)

54 - 36 \* x

Use the Second Derivative Test, f’(x) = 0, x=-2, x =5 are the local critical points, the extreme is f(-2) = -204, f(5)=825

**Answer:** the local minima and maxima are (-2, -204) and (5, 825).

**21.**  A beauty supply store expects to sell 120 flat irons during the next year. It costs to store one flat iron for one year. To reorder, there is a fixed cost of , plus for each flat iron ordered. In what lot size and how many times per year should an order be placed to minimize inventory costs?

If reorder x irons each time, then inventory cost estimate by using inventory average number (VC) = 1.6 \* (x/2)

Product cost and storage cost (PC) = (6 + 4.5x) \* 120/x

Total cost /order f = 1.6 \* (x/2) + (6 + 4.5x) \* 120/x = 0.8\*x + 720/x + 540

0 < x ≤ 120

f ’ = Deriv(f) = 0.8 - 720/x^2

the critical value while *f ‘(x)* = 0

0.8 - 720/x^2 = 0

x = 30

**Answer:** each year ordering 30 irons for 4 times will minimize inventory costs.

**22.**  A shipping company must design a closed rectangular shipping crate with a square base. The volume is . The material for the top and sides costs $3 per square foot and the material for the bottom costs $5 per square foot. Find the dimensions of the crate that will minimize the total cost of material.

Let the square length be x, and high be h, V = x^2 \*h = 18432, so h = 18432/x^2

Cost (bottom) = 5\*x^2

Cost (top and sides) = 3\*x^2+3\*4\*xh

Total cost = 5\*x^2 + 3\*x^2+3\*4\*xh

= 5\*x^2 + 3\*x^2+3\*4\*x\*18432/x^2

= 5\*x^2 + 3\*x^2+12\*18432/x

f<-function(x)5\*x^2 + 3\*x^2+12\*18432/x

first<-Deriv(f)

first

function (x)

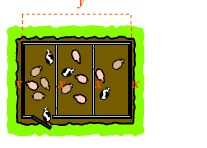
16 \* x - 221184/x^2

uniroot.all(first,c(1, 100))

[1] 24

**Answer:** 24\*24\*32 is the dimensions of the crate that costs the minimum of the material.

**23.**  A farmer wants to build a rectangular pen and then divide it with two interior fences. The total area inside of the pen will be . The exterior fencing costs and the interior fencing costs . Find the dimensions of the pen that will minimize the cost.



yards

*y =*

yards

*x =*

44

24

**Answer: the dimension of the pen should be 24\*44.**

The area of the pen: x \* y = 1056, so y = 1056/x

The cost of exterior fencing: 14.4\*(2\*y+2\*x)

The cost of interior fencing: 12\*2\*x

The total cost of fencing = 24\*x + 28.8\*(1056/x + x)

f<-function(x)24\*x + 28.8\*(1056/x + x)

first<-Deriv(f)

first

function (x)

24 + 28.8 \* (1 - 1056/x^2)

> uniroot.all(first,c(1, 100))

[1] 24

**24.**  It is determined that the value of a piece of machinery declines exponentially. A machine that was purchased 7 years ago for $67000 is worth $37000 today. What will be the value of the machine 9 years from now? Round your answer to the nearest cent.

Let decline rate be k, it is unlimited decline, t is the years of decline, t = 0 as 7 years ago, t = 7 today, and t = 16 in 9 years:

*f (t)* = A*e*kt

67000 = A*e*0\*t, so A = 67000

37000 = 67000*e*7k

*k* = (ln(37/67))/7

*f* (16) = 67000e7k = 67000e16\*(ln(37/67))/7 = 67000 \* (37/67)^16/7 = $17244.50

**Answer:** the decline rate will be $17244.50.

**25.**  The demand function for a television is given by dollars. Find the level of production for which the revenue is maximized.

*f(x)* =

*f* ‘(x) =

the critical value when *f’(x)* = 0

x = 29

**Answer:** the level of production 29 will maximize the revenue.

**26.**  The amount of goods and services that costs $ on January 1, costs $ on January 1, . Estimate the cost of the same goods and services on January 1, 2017. Assume the cost is growing exponentially. Round your answer to the nearest cent.

Let t is in years, and t = 0 as in 1995, t = 11 in 2006, and t = 22 in 2017, and k be the growth rate:

f (t) = A*e*kt

400 = A*e*0\*t, so A = 400

426.8 = 400*e*11k

k = (ln(426.8/400))/11

f(22) = 400*e*22k = 400*e*22\*(ln(426.8/400))/11 = 400 \* (426.8/400)2 = $455.40

**Answer:** the cost in 2017 will be $455.40.

**27.**  A manufacturer has determined that the marginal profit from the production and sale of clock radios is approximately dollars per clock radio.

**Step 1.** Find the profit function if the profit from the production and sale of clock radios is $1700.

MF(x) = 380 – 4x

TF(x) = =+ C

TF(38) = 380 \*38 – 2\*38\*38 + C = 1700

C = - 9852

Profit Function TF(x) = – 9852

**Answer:** the profit function TF(x) = – 9852

**Step 2.** What is the profit from the sale of 56 clock radios?

TF(56) = – 9852 = 5156

**Answer:** 5156

**28.**  Use integration by substitution to solve the integral below.

Let u = ln(y), then du/dy = 1/y, du = 1/y dy

= -5\* = -5\* = -5\* /4 + C = -5/4\*(ln(y))^4 + C

**Answer:** -5/4\*(ln(y))^4 + C

**29.**  It was discovered that after *t* years a certain population of wild animals will increase at a rate of animals per year. Find the increase in the population during the first 9 years after the rate was discovered. Round your answer to the nearest whole animal.

Find the function p(t) by solving

= 75t – 9\*2/3 \*t^3/2 + C = 75t – 6t^(3/2) + C

The increase for the first 9 years p(9) – p(0) = 75 \* 9 – 6\*9^3/2 = 513

**Answer:** the increase for the first 9 years is 513.

**30.**  Find the area of the region bounded by the graphs of the given equations.

Enter your answer below.

Solve the bounded area, x = 1, y = 6, and x = 0, y = 0. So when the bounded area is between 0 and 1.

= 4 - 2 = 4\*1 – 2\*1 = 2

**Answer:** 2

**31.**  Solve the differential equation given below.

dy/y = x^3dx integrating each side,

=

Ln(y) = x^4/4

**Answer**:

**32.**  Use integration by parts to evaluate the definite integral below.

Write your answer as a fraction.

Let u = x, then du/dx = 1

Let dv = (x+7)dx, then v = = 2/3 \*(x+7)^(1/2)

= -

= -

= - - -

= -

**Answer:** -

**33.**  The following can be answered by finding the sum of a finite or infinite geometric sequence. Round the solution to 2 decimal places.

A rubber ball is dropped from a height of meters, and on each bounce it rebounds up % of its previous height.

**Step 1.** How far has it traveled vertically at the moment when it hits the ground for the time?

Drop = 46+46\*.22+46\*.22^2+46\*.22^3+46\*.22^4+46\*.22^5+46\*.22^6+46\*.22^7+46\*.22^8+46\*.22^9+46\*.22^10+ 46\*.22^11+46\*.22^12+46\*.22^13+46\*.22^14+46\*.22^15+46\*.22^16+46\*.22^17+46\*.22^18+46\*.22^19+46\*.22^20

= 58.97

Bounce = 46\*.22+46\*.22^2+46\*.22^3+46\*.22^4+46\*.22^5+46\*.22^6+46\*.22^7+46\*.22^8+46\*.22^9+46\*.22^10+46\*.22^11+46\*.22^12+46\*.22^13+46\*.22^14+46\*.22^15+46\*.22^16+46\*.22^17+46\*.22^18+46\*.22^19+46\*.22^20

= 12.97

Drop + Bounce = 71.95 meters

**Answer:** 71.95 meters

**Step 2.** If we assume it bounces indefinitely, what is the total vertical distance traveled?

Drop = 46/(1-.22) = 58.97436

Bounce = 46\*.22/(1-.22) = 12.97436

Drop + Bounce = 71.95 meters

**Answer:** 71.95 meters

**34.**  Find the Taylor polynomial of degree near for the following function.

y’ \* 5 =

y’’ = \*5 =

y’’’ = \*5 =

y’’’’ = \*5 =

y’’’’’ =\*5 =

p5(x) = y(4) + y’(4) (x-4) + y’’(4) (x-4)^2/2 + y’’’(4) (x-4)^3/(3\*2) + y’’’’(4)(x-4)^4/(4\*3\*2) + y’’’’’(4)(x-4)^5/(5\*4\*3\*2) = + + + + +

**Answer:**  + + + + +

**Linear Algebra**

1. Using matrix operations, describe the solutions for the following family of equations:

x + 2y - 3z = 5

2x + y - 3z = 13

-x + y + 2z= -8

a.  Find the inverse of the above 3x3 (non-augmented) matrix.

A =

R2 + 2R3 = R2, R3 + R1 = R3

R1 + 3R2 = R1, R2 + R3 = R2, (-1)R3 = R3

2R3 + R2 = R3

(-6)R1 + 11R2 = R1, (1/6)R2 = R2, (1/2)R3 = R3

R1/(-6) = R1

A = matrix(c(1, 2, -1, 2, 1, 1, -3, -3, 2), 3, 3)`

Solve(A)

A-1 =

**Answer**: A-1 =

b.  Solve for the solution using R.

B <- c(5, 13, -8)

x <- solve(A)%\*% B

**Answer**: x

[,1]

[1,] 7

[2,] -1

[3,] 0

c.  Modify the  3x3 matrix such that there exists only one non-zero variable in the solution set.

**Answer**:

A <- matrix(c(5, 13, -8, 1, 2, -1, -3, -3, 2), ncol = 3, nrow = 3)

solve(A) %\*% B

[,1]

[1,] 1

[2,] 0

[3,] 0

1. Consider the matrix, q=matrix(c(3,1,4,4,3,3,2,3,2),nrow=3). Let b=c(1,4,5).  Use Cramer's rule and R to determine the solution, x, to qx=b, if one exists.  Show all determinants.

q=matrix(c(3,1,4,4,3,3,2,3,2),nrow=3)

b=c(1,4,5)

solve(q)%\*%b

[,1]

[1,] 1.461538

[2,] -2.538462

[3,] 3.384615`

D = det(q) = 13

Dx = det(matrix(c(1, 4, 5, 4,3,3,2,3,2), nrow=3)) = 19

Dy = det(matrix(c(3,1,4,1,4,5,2,3,2), nrow=3)) = -33

Dz = det(matrix(c(3,1,4, 4,3,3, 1,4,5), nrow=3)) = 44

x = Dx/D = 19/13 = 1.461538

y = Dy/D = -33/13 = -2.538462

z = Dz/D = 44/13 = 3.384615

**Answer**: