1.The manager of a furniture factory finds that it costs Rs.2200 to manufacture 100 chairs in one day and Rs.4800 to produce 300 chairs in one day.

(a) Express the cost as a function of the number of chairs produced,assuming that it is linear. Sketch the graph.

(b)What is slope of graph and what does it represent?

(c)What is y-intercept and it represents?

(d)Estimate cost to produce 400 chairs.

Solution:

Here Let b=y= y-intercept = fixed daily cost of operating the factory

m=slope

n=number of chairs produced in one day

c=cost of manufacturing a chair

The given example can be modelled in terms of linear function y(x)=mx+c

```
syms x y m c
y(x)=m*x+c;
eq1=[y(100)==2200, y(300)==4800]
```

eq1 = $\left(c + 100\,m = 2200 \quad c + 300\,m = 4800\right)$

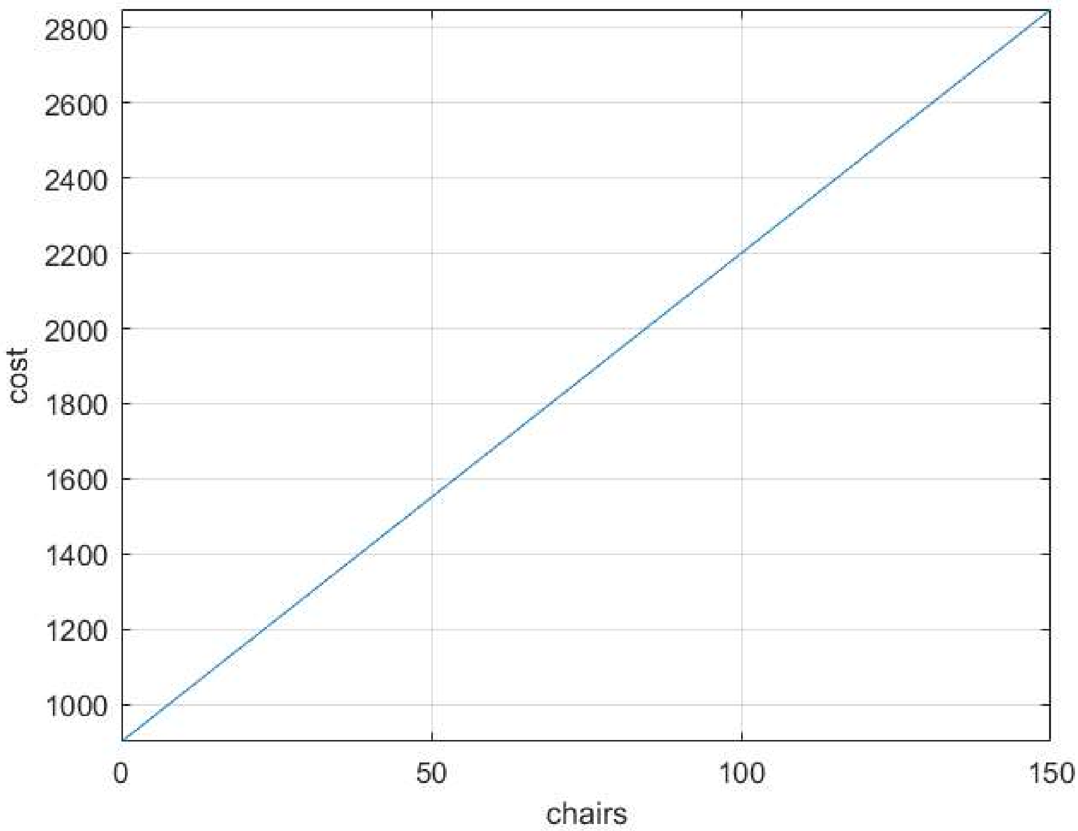
```
[m,c]=solve(eq1,[m c])
```

m = 13
c = 900

```
y(x)=subs(y(x))
```

y(x) = $13\,x + 900$

```
fplot(y(x),[0,150])
grid on
xlabel('chairs')
ylabel('cost')
```




```
%(b)
slope = m %Cost of producing each additional chair
```

```
slope = 13
```

```
%(c)
y_int= c%fixed daily cost
```

```
y_int = 900
```

```
%(d)
c_pred=y(400)
```

```
c_pred = 6100
```

```
% graph is straight line and positive slope indicates that
% as no. of chairs increases, cost also increases
```

2.Residents of city are billed a fixed amount yearly plus a charge for each cubic foot of water used. A household using 1000 cubic feet was billed Rs.90,while one using 1600 cubic feet was billed Rs.105.

(a)Build mathematical model for total cost of residents water in terms of cubic feet of water jused.

(b)How many cubic feet of water used would lead to a bill of Rs.130?

(c)Sketch the graph

Solution:

```
%Graph of function
```

```
%(a)
syms y x m c
y(x)=m*x+c
```

y(x) = $c + m\,x$

```
eq1=[y(1000)==90,y(1600)==105]
```

eq1 = $(c + 1000\,m = 90 \quad c + 1600\,m = 105)$

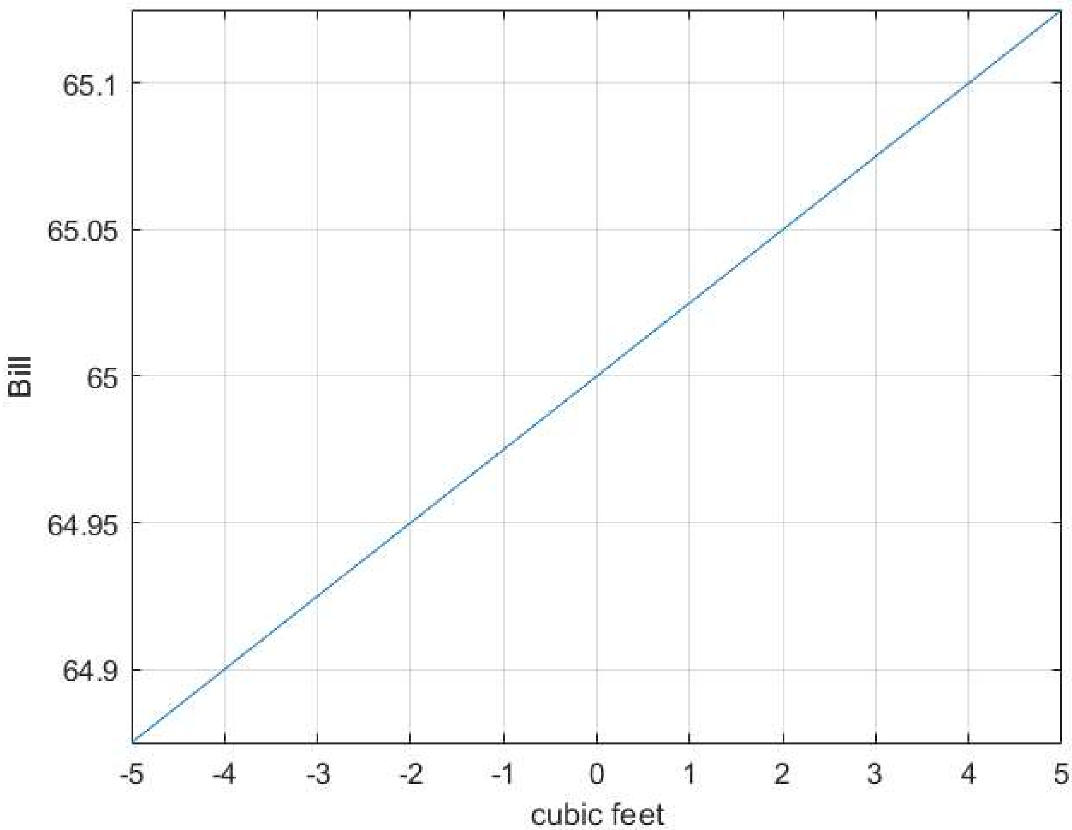
```
[m,c]=solve(eq1,[m,c])
```

m =
$\frac{1}{40}$
c = 65

```
y(x)=subs(y(x))
```

y(x) =
$\frac{x}{40} + 65$

```
fplot(y(x))
xlabel('cubic feet')
ylabel('Bill')
grid on
```




```
%(b)
c_pred=y(130)
```

c_pred =

$$\frac{273}{4}$$

```
%(c)
%Graph is a straight line and indicates that as area of cubic feet
%increases so does the bill
```

Example 3: Biologists have observed that the chirping rate of crickets of a certain species appears to be related to temperature. The table shows the chirping rates for various temperatures.

Temperature(F) : 50 55 60 65 70 75 80 85 90

Chirping rate (chirps/min) : 20 46 79 91 113 140 179 198 211

(a)Make a scatter plot of data.

(b)Use the linear model to estimate the chirping rate at 100F

(c) Sketch the graph of model.

```
%Graph of function
%(a)
syms m c y x
temp=[50 55 60 65 70 75 80 85 90] %temp in deg
```

```
temp = 1×9
    50    55    60    65    70    75    80    85    90
```

```
chirp_rate=[20 46 79 91 113 140 179 198 211] %chirps/min
```

```
chirp_rate = 1×9
    20    46    79    91   113   140   179   198   211
```

```
scatter(temp,chirp_rate,'ro', 'cyan',"filled")
grid on
%(b)Chirp rate as function of temperature
y(x)=m*x+c
```

y(x) = $c+m\,x$

```
eq3=[y(50)==20, y(90)==211]
```

eq3 = $\begin{pmatrix} c+50\,m=20 & c+90\,m=211 \end{pmatrix}$

```
[m,c]=solve(eq3,[m c])
```

m =
$$\frac{191}{40}$$
c =
$$-\frac{875}{4}$$

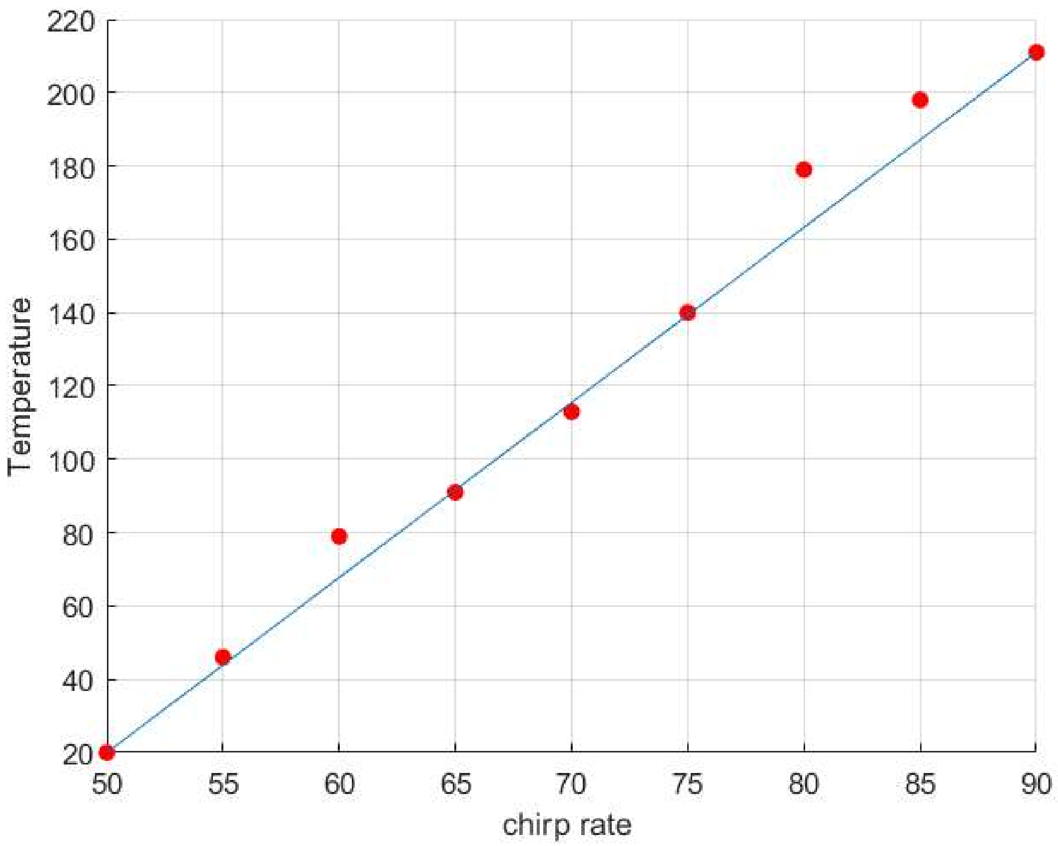
```
y(x)=subs(y(x))
```

y(x) =
$$\frac{191\,x}{40}-\frac{875}{4}$$

```
%(c)
c_pred=round(y(100))
```

c_pred = 259

```
%(d)
hold on
fplot(y(x),[50,90])
hold off
grid on
xlabel('chirp rate ')
ylabel('Temperature')
```




```
%for 135 draw horizontal and vertical line.
```

4. A bacteria culture initially contains 100 cells and grows at the rate proportional to its size. After an hour the population has increased to 420.

(a) Find the number of bacteria after t hours.

(b) Find the number of bacteria after 3 hours.

(c) When will the population reach 10,000?

(d) Graph the model.

Solution:

P=Po*a^t

```
syms p a t
```

```
p(t)=100*a^t
```

p(t) = $100a^t$

```
eqn=p(1)==420
```

eqn = $100a = 420$

```
a=solve(eqn,a)
```

a =
$\frac{21}{5}$

```
p(t)=subs(p(t))
```

p(t) =
$100\left(\frac{21}{5}\right)^t$

```
%This gives the required model
```

```
%(b)Number of bacteria after 3 hours.
p_pred3=p(3)
```

p_pred3 =
$\frac{37044}{5}$

```
p_pred3=round(p(3))
```

p_pred3 = 7409

```
p_pred3=double(p(3))
```

p_pred3 = 7.4088e+03

```
p_pred3=double(round(p(3)))
```

p_pred3 = 7409

```
%(c)Time to reach population of 10,000 people.
t_pred=solve(p(t)==10000,t)
```

t_pred =
$-\frac{2\log(10)}{\log\left(\frac{5}{21}\right)}$

```
t_pred3=double(t_pred)
```

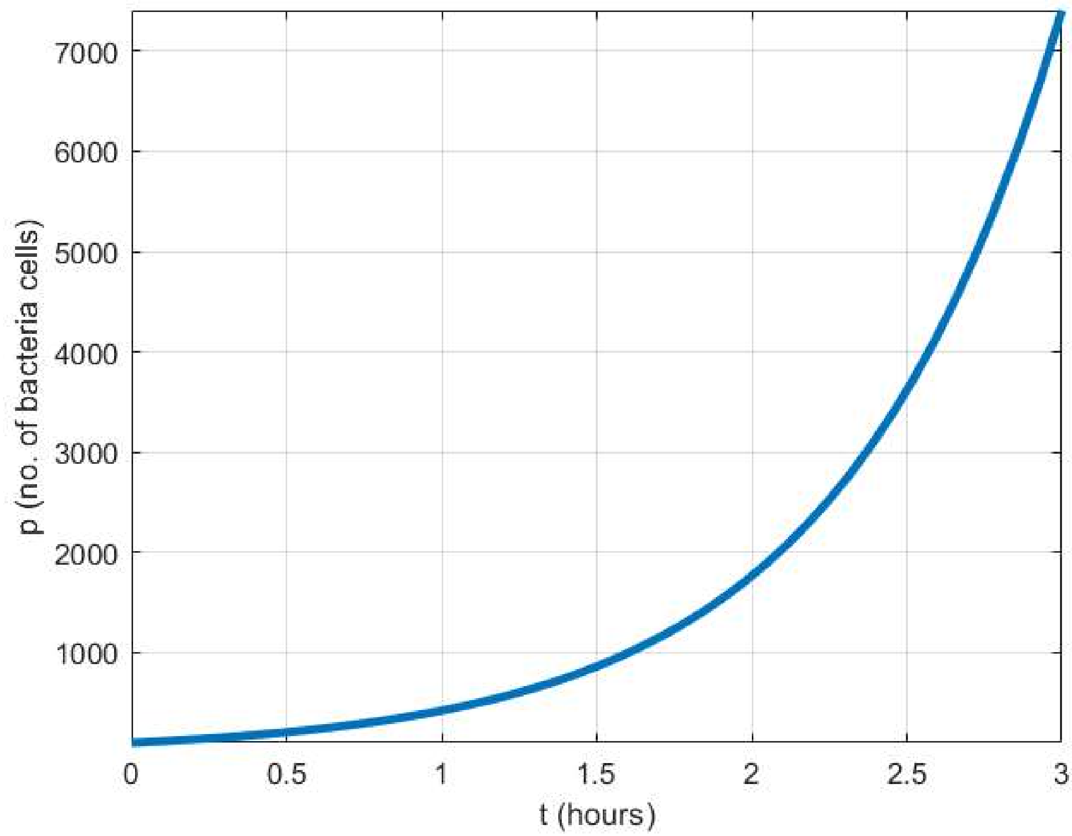
t_pred3 = 3.2090

```
t_pred3=round(double(t_pred))
```

t_pred3 = 3

```
%(d)Graph the model.
fplot(p(t),[0 3],'Linewidth',3)
```

```
grid on
xlabel('t (hours)')
ylabel('p (no. of bacteria cells)')
hold off
```




```
%Rate of growth starts slowly then increases fast as time increases.
```

5.Strontium-90 has a half-life of 28 days.

(a)A sample of mass 50 mg initially. Find a formula for the mass remaining after t days.

(b)Find the mass remaining after 40 days.

(c)How long does it take for the sample to decay to a mass of 2 mg?

(d)Sketch the graph of the mass function

Solution:

P=Po*a^t

```
syms p a t positive
p(t)=50*a^t
```

p(t) = $50\,a^t$

```
eqn=p(28)==25
```

eqn = $50\,a^{28} = 25$

```
a=solve(eqn,a)
```

a =

$$\frac{2^{27/28}}{2}$$

```
p(t)=subs(p(t))
```

p(t) =

$$50\left(\frac{2^{27/28}}{2}\right)^t$$

```
%This gives the required model
```

```
%Mass remaining after 40 days
p_pred=p(40)
```

p_pred =

$$\frac{25\,2^{4/7}}{2}$$

```
p_pred=round(p(40))
```

p_pred = 19

```
p_pred=double(p(40))
```

p_pred = 18.5749

```
p_pred=double(round(p(40)))
```

p_pred = 19

```
%Time taken for sample to decay to a mass of 2 mg
t_pred=solve(p(t)==2,t)
```

t_pred =

$$-\frac{2\log(5)}{\log\left(\frac{2^{27/28}}{2}\right)}$$

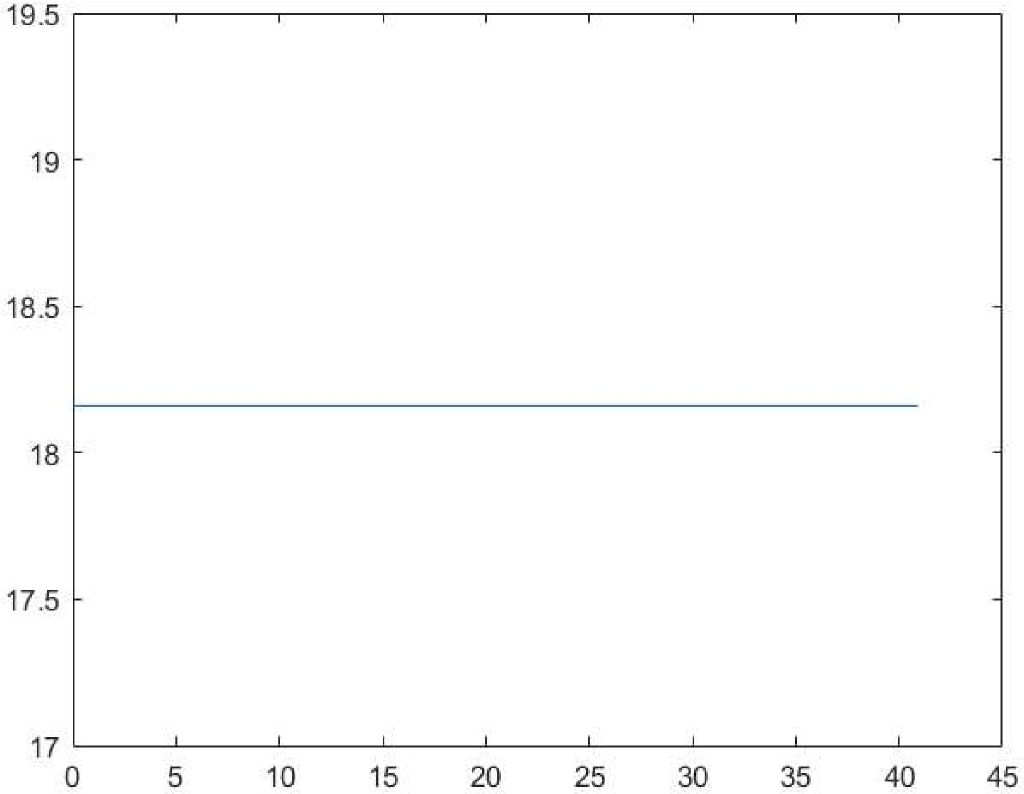
```
t_pred3=double(t_pred)
```

t_pred3 = 130.0280

```
t_pred3=round(double(t_pred))
```

t_pred3 = 130

```
%Graph of mass function
plot([0,40.91],[18.16,18.16])
hold on
```




```
fplot(p(T),[0 100],'Linewidth',3)
```

Undefined function or variable 't'.

```
grid on
xlabel('t(hours)')
ylabel('p(Mass remaining)')
hold off
% As time increases the amount of mass gets decayed.
% Therefore Mass is inversely proportional to time.
```

6.

```
clear all
clc
syms p a t positive
p(t)=40000000*(a^t)
```

p(t) = $40000000a^t$

```
eq=p(10)==56000000
```

eq = $40000000a^{10} = 56000000$

```
a=solve(eq,a)
```

a =
$$\frac{5^{9/10}\,7^{1/10}}{5}$$

```
p(t)=subs(p(t))
```

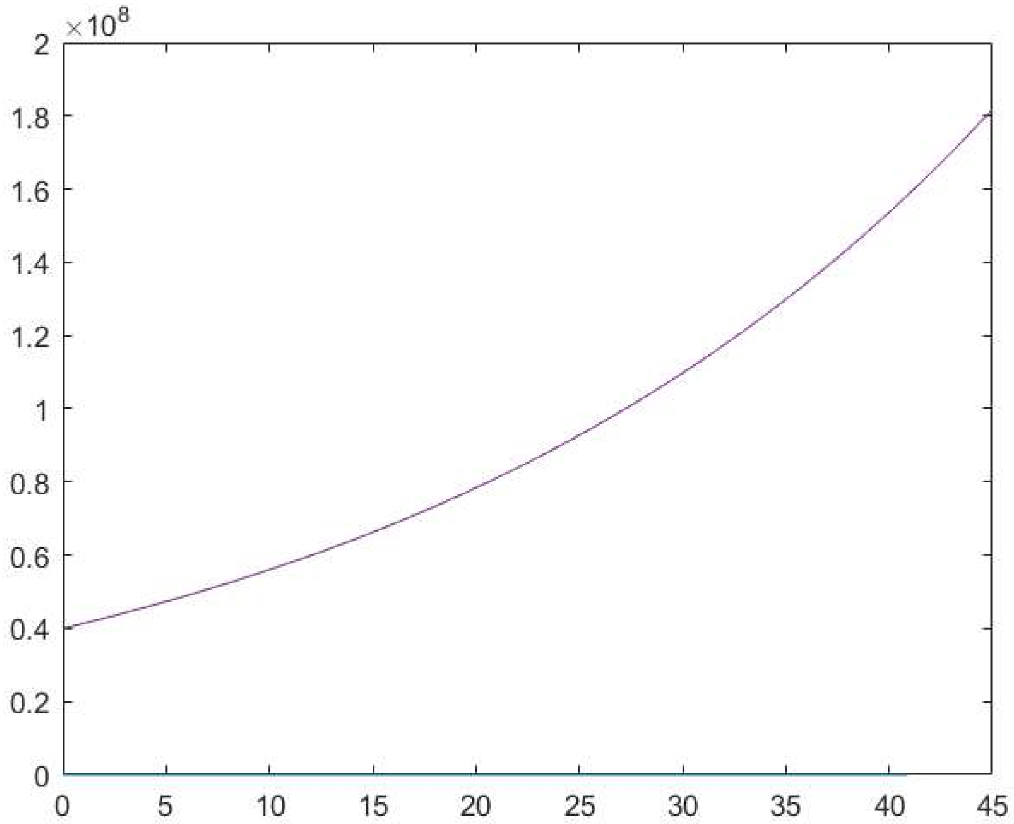
p(t) =

$$40000000\left(\frac{5^{9/10}\,7^{1/10}}{5}\right)^{t}$$

```
p_pred=double(round(p(20)))
```

p_pred = 78400000

```
fplot(p(t))
```




```
dt=solve(p(t)==80000000,t)
```

dt =

$$\frac{\log(2)}{\log\left(\frac{5^{9/10}\,7^{1/10}}{5}\right)}$$

```
dt1=double(dt)
```

dt1 = 20.6004

7.

```
syms p a t j
p(j) = 100*(exp(-0.17*t))
```

p(j) =

$$100\,\mathrm{e}^{-\frac{17\,t}{100}}$$

```
eqn=p(j)==50
```

eqn =

$$100\,e^{-\frac{17\,t}{100}} = 50$$

```
a=solve(eqn,t)
```

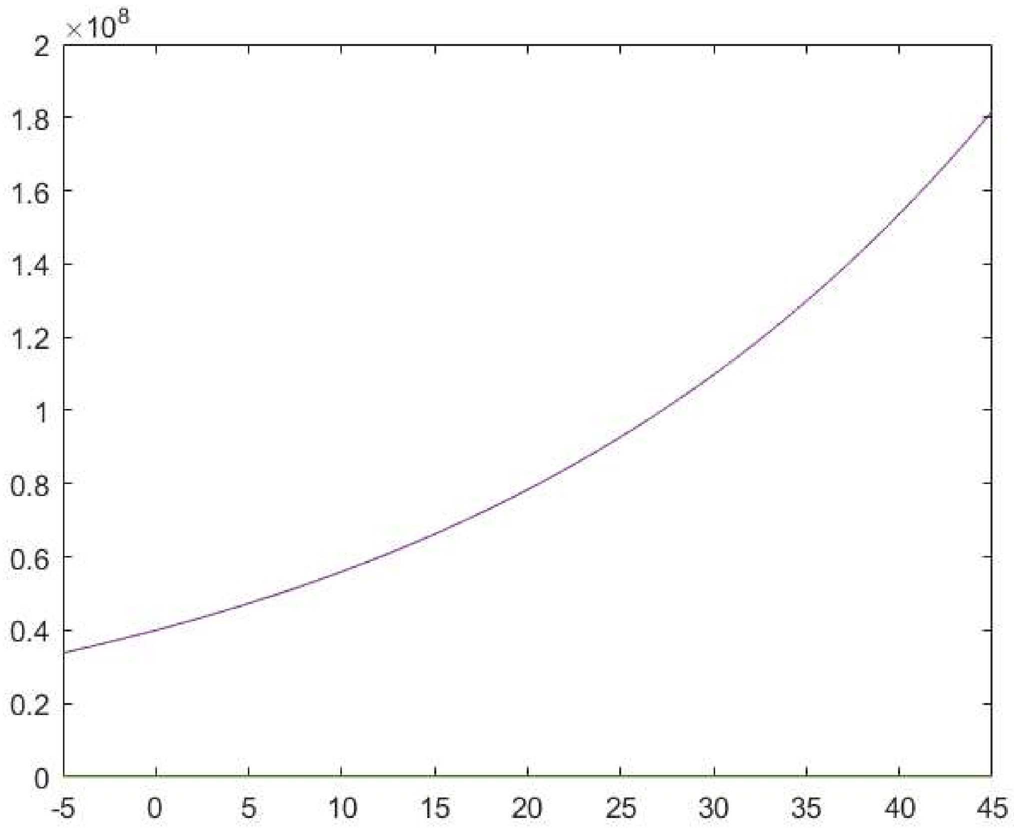
a =

$$\frac{100\log(2)}{17}$$

```
xs=double(a)
```

xs = 4.0773

```
fplot(p(j))
```



8.

A ferris wheel with a radius of 25 feet is rotating at a rate of 3 revolutions per minute. When t = 0, a chair starts at the lowest point on the wheel, which is 5 feet above the ground. Write a model for the height h (in feet) of the chair as a function of time t (in seconds).

SOLUTION:

```
syms t T a b x h k
%We will draw the Trigonometric Model
f(x) = a*cos(b*x)+k
```

f(x) = $k + a\cos(b\,x)$

```
% radius = 25 feet , therefore diameter= 2*radius = 50 feet
```

```
%50+5=55 maximum point
M=55
```

M = 55

```
m=5
```

m = 5

```
k = (M+m)/2 %Vertical shift of the graph
```

k = 30

```
amp = (M-m)/2 %Amplitude of the graph
```

amp = 25

```
%Bevause minimum value occurs on the y-axis axis is negative.
a = -amp
```

a = -25

```
%To find period

eq=(2*pi)/b==20
```

eq =

$$\frac{2\,\pi}{b} = 20$$

```
b=solve(eq,b)
```

b =

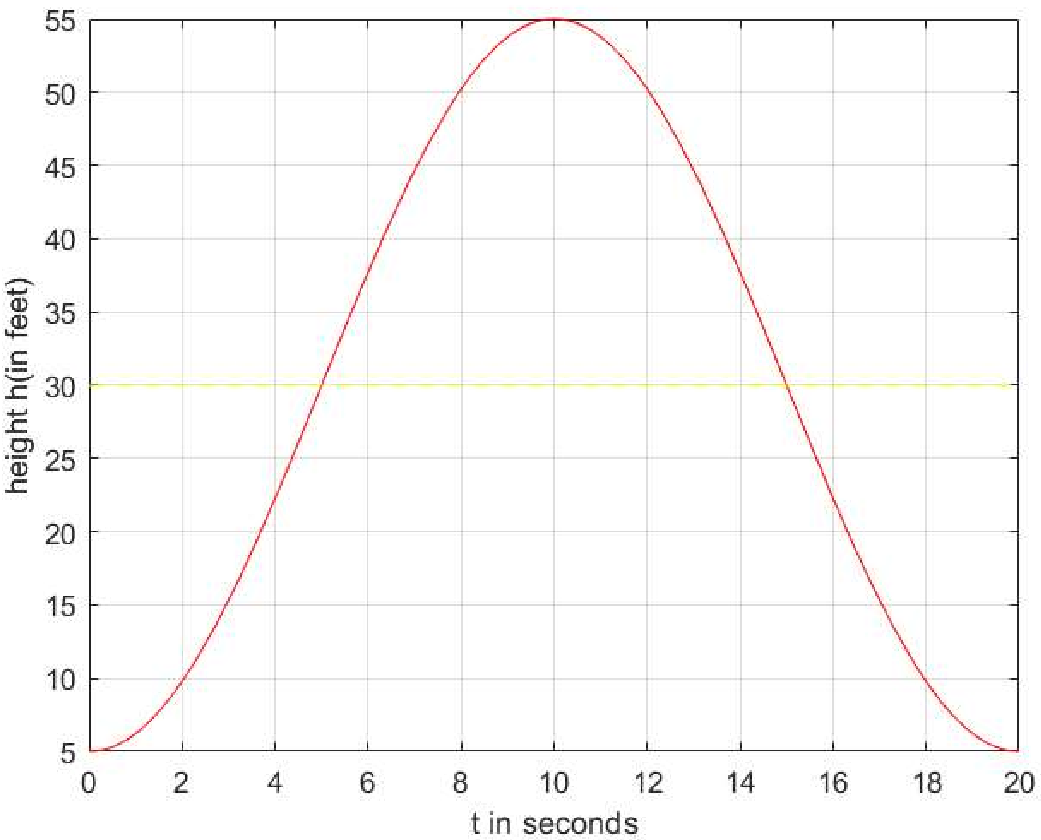
$$\frac{\pi}{10}$$

```
f(x)=subs(f(x))
```

f(x) =

$$30 - 25\cos\left(\frac{\pi\,x}{10}\right)$$

```
%This gives the required model (T as a function of t).
fplot(f(x) ,[0,20],'r')
hold on
grid on
plot([0 20],[30 30],'y--')
xlabel('t in seconds')
ylabel('height h(in feet)')
hold off
```



Ex.9 :

A farmer has 1200m of fencing and wants to fence off a rectangular field that borders a straight river. He needs no fence along the river, what are the dimensions of the field that has the largest area?

```
syms x
A = x*(1200-2*x)
```

A = $-x\ (2\,x - 1200)$

```
%The total length of fencing is 1200m.
A1 = diff(A)
```

A1 = $1200 - 4\,x$

```
% 0 <= x <= 600
critical_point=solve(A1)
```

critical_point = 300

```
%Now we apply second derivate test to find the sign of A``
diff(A1)
```

ans = -4

```
%As Second derivate is negative, it implies that area will be maximum at
%the critical point x = 300.
Max_area=subs(A,x,critical_point)
```

Max_area = 180000

10. A man launches his boat from point A on a bank of a straight river 3Km wide and wants to reach point B, 8 Km downstream on the opposite bank, as quickly as possible. He could row his boat directly across the river to point C and then run to B. If he can row 6Km/h and run 8Km/h, where should he land to reach B as soon as possible.

```
syms x
T(x)=(sqrt(x^2+9)/6)+((8-x)/8)
```

T(x) =

$$\frac{\sqrt{x^2+9}}{6} - \frac{x}{8} + 1$$

```
Td(x)=diff(T(x),x)
```

Td(x) =

$$\frac{x}{6\sqrt{x^2+9}} - \frac{1}{8}$$

```
cp= solve (Td(x))
```

cp =

$$\frac{9\sqrt{7}}{7}$$

```
Tcp=(T(cp))
```

Tcp =

$$\frac{\sqrt{7}}{8} + 1$$

```
double (Tcp)
```

ans = 1.3307

```
x = 0 ; TO=double(T(0))
```

TO = 1.5000

```
x = 8 ; Tend=double(T(8))
```

Tend = 1.4240

```
%Shortest time = minimum of Tcp
st = double (min([Tcp,TO,Tend]))
```

st = 1.3307

```
%OR
if Tcp<TO && Tcp<Tend
        fprintf('shortest time is %f',Tcp)
else if TO<Tend && TO<Tcp
        fprintf('shortest time is %f',TO)
else
        fprintf('shortest time is %f',Tend)
```

```
end
end
```

```
shortest time is 1.330719
```

```
%Hence we have obtained the shortest time to reach point B.
```

11. A man at a point A on the shore of a circular lake with radius 2 m wants to arrive at the point C diametrically opposite A on the other side of the lake in the shortest time possible. Construct the model for the way he should proceed? If he can walk at the rate of 4 m/hr and row a boat at 2 m/hr.

```
syms x
T(x) = 2*cos(x) + x
```

T(x) = $x+2\cos(x)$

```
Td(x)=diff(T(x),x)
```

Td(x) = $1-2\sin(x)$

```
cp= solve (Td(x))
```

cp =

$$\begin{pmatrix} \frac{\pi}{6} \\ \frac{5\pi}{6} \end{pmatrix}$$

```
cp=pi/6
```

```
cp = 0.5236
```

```
Tcp=(T(cp))
```

Tcp =

$$\frac{\pi}{6}+\sqrt{3}$$

```
double (Tcp)
```

```
ans = 2.2556
```

```
x = 0 ; TO=double(T(0))
```

```
TO = 2
```

```
x = pi/2 ; Tend=double(T(x))
```

```
Tend = 1.5708
```

```
%OR
if Tcp<TO && Tcp<Tend
        fprintf('Minimum value is %f',Tcp)
else if TO<Tend && TO<Tcp
        fprintf('Minimum value is %f',TO)
else
        fprintf('Minimum value is %f',Tend)
```

```
end
end
```

```
Minimum value is 1.570796
```

```
%Hence we have obtained the shortest time to reach point C.
```

12. N-R Method

```
syms x
f(x) = x*sin(x)+cos(x)
```

f(x) = $\cos(x) + x\sin(x)$

```
df(x)=diff(f(x))
```

df(x) = $x\cos(x)$

```
x0=pi;
err=0.0001;
maxit=10;
for k=1:maxit;
    h=f(x0)/df(x0);
    x1=x0-h;
    fprintf('The iteration of %d, has a value of %4.4f\n',k,x1);
    if(abs(h)<err)
        fprintf('After iteration of %d, value is %f\n',k,x1);
    return
    end
    x0=x1;
end
```

```
The iteration of 1, has a value of 2.8233
The iteration of 2, has a value of 2.7986
The iteration of 3, has a value of 2.7984
The iteration of 4, has a value of 2.7984
After iteration of 4, value is 2.798386
```

13. Taylor Series

Example 1 : Find the Taylor series for f(x)=e^x at a=2

```
syms x
taylor(exp(x),x,'Expansionpoint',2)
```

ans =

$$e^2 + e^2\ (x-2) + \frac{e^2\,(x-2)^2}{2} + \frac{e^2\,(x-2)^3}{6} + \frac{e^2\,(x-2)^4}{24} + \frac{e^2\,(x-2)^5}{120}$$

Example 2 : Find Taylor series for f(x)=ln(x) at a=2

```
syms x
taylor(log(x),x,'Expansionpoint',2)
```

ans =

$$\frac{x}{2} + \log(2) - \frac{(x-2)^2}{8} + \frac{(x-2)^3}{24} - \frac{(x-2)^4}{64} + \frac{(x-2)^5}{160} - 1$$

Example 3 : Find the Taylor series for f(x)=sinx at x=pi/6 upto 9th order

```
syms x
taylor(sin(x),x,'Expansionpoint',pi/6)
```

ans =

$$\frac{\sqrt{3}\left(x-\frac{\pi}{6}\right)}{2}-\frac{\sqrt{3}\left(x-\frac{\pi}{6}\right)^3}{12}+\frac{\sqrt{3}\left(x-\frac{\pi}{6}\right)^5}{240}-\frac{\left(x-\frac{\pi}{6}\right)^2}{4}+\frac{\left(x-\frac{\pi}{6}\right)^4}{48}+\frac{1}{2}$$

Example 4 : f(x)=1+x+x^2

```
syms x
taylor(1+x+x^2,x)
```

ans = x^2+x+1

14. Maclaurian series

1. Find the Maclaurian series for f(x)=sin(2x)

```
syms x
taylor(sin(2*x))
```

ans =

$$\frac{4\,x^5}{15}-\frac{4\,x^3}{3}+2\,x$$

2. Find the Maclaurian series for f(x)=cos(x)

```
syms x
taylor(cos(x))
```

ans =

$$\frac{x^4}{24}-\frac{x^2}{2}+1$$

15.

(i) Evaluate $\int_0^1 \frac{1}{1+x^2}.\mathrm{dx}$

```
syms x
f(x)=1/(1+x^2)
```

f(x) =

$$\frac{1}{x^2+1}$$

```
int(f(x))
```

ans = $\mathrm{atan}(x)$

```
int(f(x),0,1)
```

ans =

$$\frac{\pi}{4}$$

(ii) Evaulate $\int_0^{\frac{\pi}{2}} \sin^6 x \cos^6 x dx$

```
syms x
f(x)=sin(x)^6*cos(x)^6
```

f(x) = $\cos(x)^6 \sin(x)^6$

```
int(f,0,pi/2)
```

ans =
$\frac{5\pi}{2048}$

(iii) Evaluate $\int_0^2 x^3 \sqrt{8 - x^3} . dx$

```
syms x
f(x)=x^3*(sqrt(8-x^3))
```

f(x) = $x^3 \sqrt{8 - x^3}$

```
I=double(int(f,0,2))
```

I = 6.9224 + 0.0000i

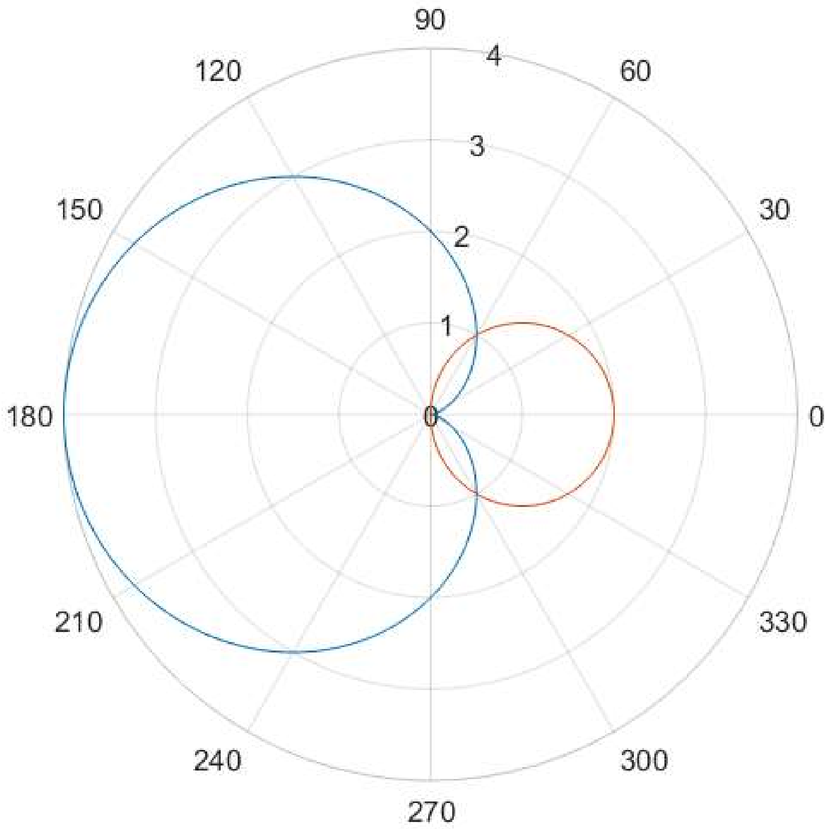
16.Trace the polar curve $r = 2(1 - \cos\Theta)$

```
theta= 0:0.01:2*pi;
r=2*(1-cos(theta));
polarplot(theta,r)
hold on
r1=2*cos(theta)
```

r1 = 1×629

2.0000	1.9999	1.9996	1.9991	1.9984	1.9975	1.9964	1.9951

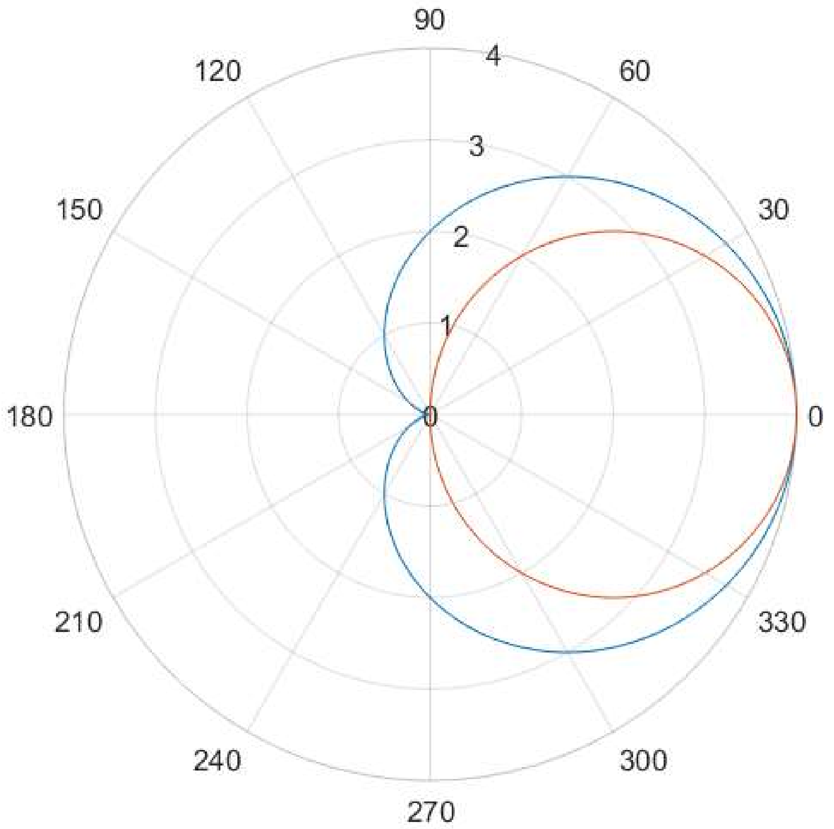
```
polarplot(theta,r1)
hold off
```




```
theta= 0:0.01:2*pi;
r=2*(1+cos(theta));
polarplot(theta,r)
hold on
r1=4*cos(theta)
```

```
r1 = 1×629
    4.0000    3.9998    3.9992    3.9982    3.9968    3.9950    3.9928    3.9902
```

```
polarplot(theta,r1)
hold off
```



17. A manufacturer of corrugated metal roofing wants to produce panels that are 28 in. wide and 2 in. thick by processing flat sheets of metal. Find the width w of a flat sheet that is needed to make a 28-inch panel.

Solution :

The profile of the roofing takes the shape of a sine wave.

The sine wave has amplitude 1 and period.

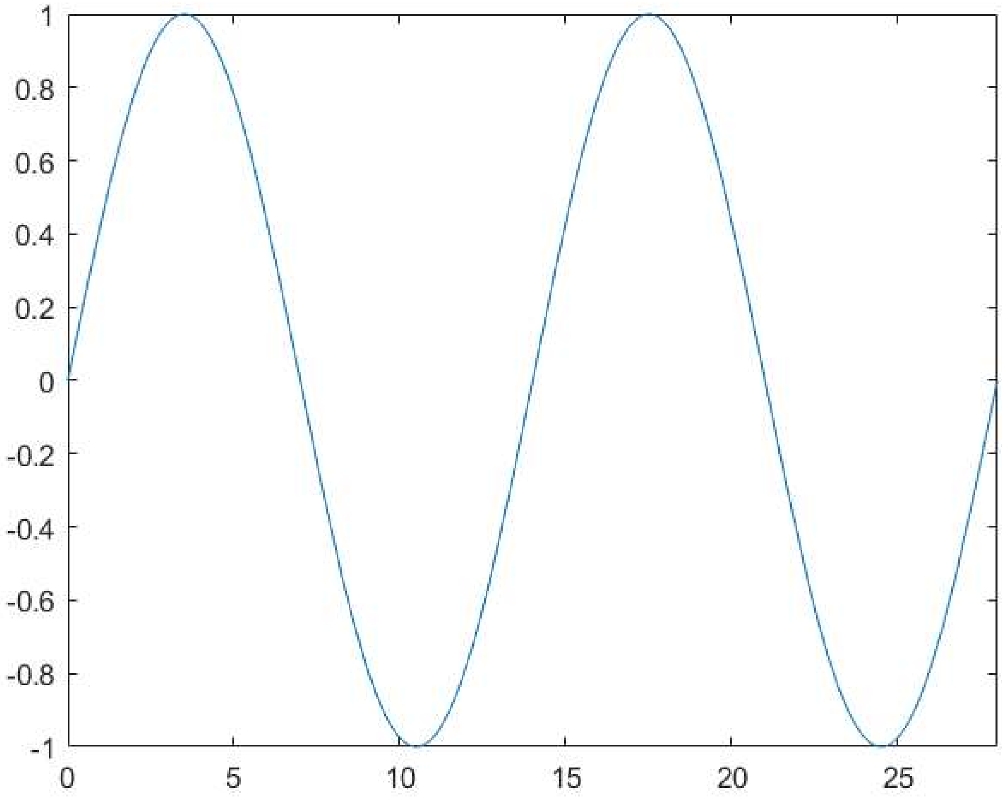
Since it goes through 2 periods in a distance of 28, so the equation is $y = 1\sin\left(\frac{2\pi}{14}x\right)$ The width w of the flat metal sheet needed to make the panel is the arc length of the since curve from x=0 to x=28. We set up the integral to $L = \int_0^{28} \sqrt{1 + \left[\frac{\pi}{7}\cos\left(\frac{\pi}{7}x\right)\right]^2}\ \mathrm{dx}$

```
syms x
y = sin(pi*x/7)
```

y =

$\sin\left(\frac{\pi\,x}{7}\right)$

```
fplot(y,[0,28])
```



```
m=diff(y)
```

m =

$$\frac{\pi \cos\left(\frac{\pi x}{7}\right)}{7}$$

```
integrand=sqrt(1+m^2)
```

integrand =

$$\sqrt{\frac{\pi^2 \cos\left(\frac{\pi x}{7}\right)^2}{49} + 1}$$

```
I=int(integrand,x,0,28)
```

I =

$$\int_0^{28} \sqrt{\frac{\pi^2 \cos\left(\frac{\pi x}{7}\right)^2}{49} + 1} \mathrm{d}x$$

```
double(I)
```

ans = 29.3607

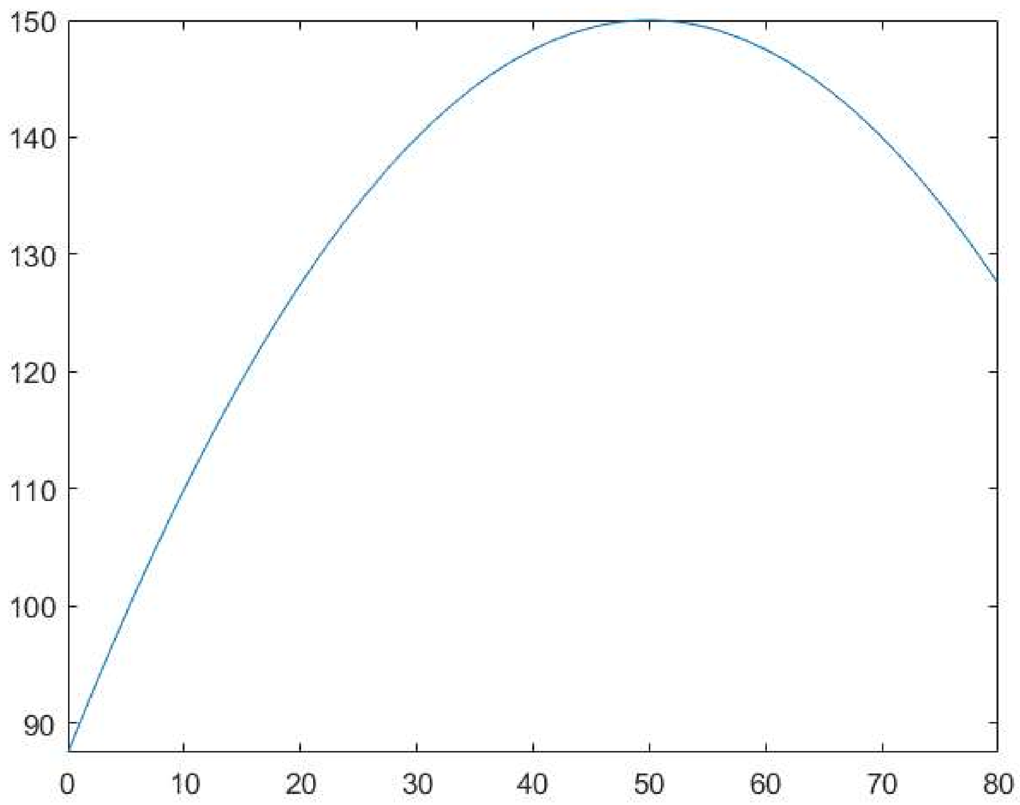
18. A steady wind blows a kite due west. The kite's height above fround from horizontal position x=0 to x=80 ft is given by $y = 150 - \frac{1}{40}(x-50)^2$ **. Find the distance travelled by the kite.**

```
syms x
y=150-(1/40)*(x-50)^2
```

y =

$$150-\frac{(x-50)^2}{40}$$

```
fplot(y,[0,80])
```




```
o=diff(y)
```

o =

$$\frac{5}{2}-\frac{x}{20}$$

```
integrand=sqrt(1+o^2)
```

integrand =

$$\sqrt{\left(\frac{x}{20}-\frac{5}{2}\right)^2+1}$$

```
I=int(integrand,x,0,80)
```

I =

$$\log\left(\left(\frac{\sqrt{13}}{2}+\frac{3}{2}\right)^{10}\left(\frac{\sqrt{29}}{2}+\frac{5}{2}\right)^{10}\right)+\frac{15\sqrt{13}}{2}+\frac{25\sqrt{29}}{2}$$

```
double(I)
```

ans = 122.7761

19. A hawk flying at an altitude of 180 m accidentally drops it prey. The parabloic

trajectory of the falling prey is described by the equation $y = 180 - \frac{x^2}{45}$ **until it hits the ground, where y is its height above the fround and x is the horizontal distance travelled in meters. Calculate the distance travlled by the prey from the time it dropped until the time it hits the ground. Express your answer to the nearest tenth of a meter.**

```
syms x
y=180-x^2/45
```

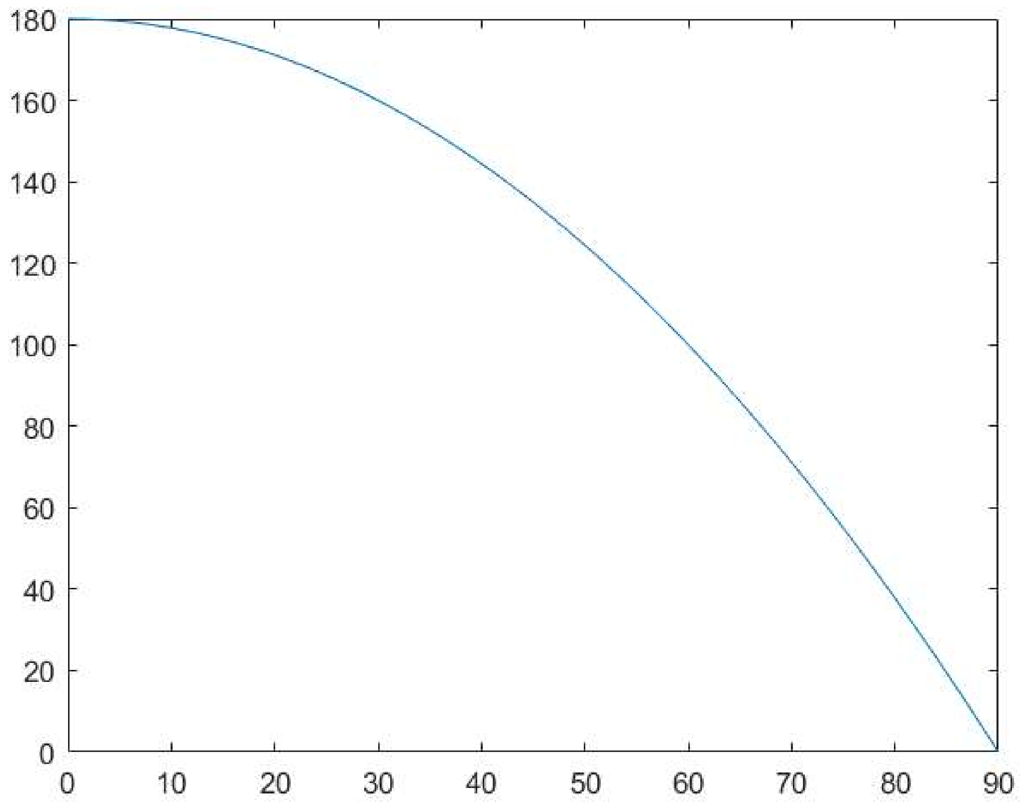
y =

$$180 - \frac{x^2}{45}$$

```
%The prey hits the ground when y=0
htg=solve(y==0,x>=0)
```

htg = 90

```
fplot(y,[0,90])
```




```
o=diff(y)
```

o =

$$-\frac{2\,x}{45}$$

```
integrand=sqrt(1+o^2)
```

integrand =

$$\sqrt{\frac{4\,x^2}{2025}+1}$$

```
I=int(integrand,x,0,90)
```

I =

$$\frac{45\log(\sqrt{17}+4)}{4}+45\sqrt{17}$$

```
double(I)
```

ans = 209.1053

Find the area and arc length for a circle with radius 500 metres. Find the parametric equations for circular playground.

20. Find the area common to the circles $r = a\sqrt{2}$ **and** $r = 2a\cos\Theta$ **.**

```
clear all
syms theta a
r1(theta)=sqrt(2)*a
```

r1(theta) = $\sqrt{2}\,a$

```
r2(theta)=2*a*cos(theta)
```

r2(theta) = $2\,a\cos(\theta)$

```
area1=(1/2)*int((r1(theta))^2,theta,0,pi/4)
```

area1 =

$$\frac{\pi\,a^2}{4}$$

```
area2=(1/2)*int((r2(theta))^2,theta,pi/4,pi/2)
```

area2 =

$$\frac{a^2\,(\pi-2)}{4}$$

```
area=2*(area1+area2)
```

area =

$$\frac{\pi\,a^2}{2}+\frac{a^2\,(\pi-2)}{2}$$

21. A group of engineersis building a parabolic satellite dish whose shape will be formed by rotating the curve about the y-axis if the dish is to have a 10-ft diameter and a maximum depth of 2 ft, find the value of a and surface area of the dish.

```
syms x a positive
y(x)=a*x^2
```

y(x) = $a\,x^2$

```
eq=2==y(5)
```

eq = $2 = 25\,a$

```
a=solve(eq,a)
```

a =
$\frac{2}{25}$

```
y(x)=subs(y)
```

y(x) =
$\frac{2\,x^2}{25}$

```
dy=diff(y(x))
```

dy =
$\frac{4\,x}{25}$

```
ds=sqrt(1+(dy)^2)
```

ds =
$\sqrt{\frac{16\,x^2}{625}+1}$

```
sa=2*pi*int(x*ds,0,5)
```

sa =
$2\,\pi\,\left(\frac{205\,\sqrt{41}}{48}-\frac{625}{48}\right)$

```
double(sa)
```

ans = 90.0119

22.Since $m' = (\rho(x))$, $m = \int_0^4 \rho(x)\,, m = \int_0^4 (9+2\,\sqrt{x})$

```
syms x
density=9+2*sqrt(x)
```

density = $2\,\sqrt{x}+9$

```
mass=int(density,0,2)
```

mass =
$\frac{8\,\sqrt{2}}{3}+18$

23.

```
syms x y t a b v
%Parametric equations of the ellipse are :
x(t)=a*cos(t)
```

x(t) = $a\cos(t)$

```
y(t)=b*sin(t)
```

y(t) = $b\sin(t)$

```
a=14
```

a = 14

```
b=12.5
```

b = 12.5000

```
x(t)=subs(x(t))
```

x(t) = $14\cos(t)$

```
y(t)=subs(y(t))
```

y(t) =
$$\frac{25\sin(t)}{2}$$

```
df=diff(x)
```

df(t) = $-14\sin(t)$

```
f=pi*(y(t)^2)*df
```

f(t) =
$$-\frac{4375\pi\sin(t)^3}{2}$$

```
v=double(2*(int(f,pi/2,0)))
```

v = 9.1630e+03

24.

```
syms x
y=x^2
```

y = x^2

```
%Surface area of the curve
df=diff(y)
```

df = $2x$

```
ds=sqrt(1+(df)^2)
```

ds = $\sqrt{4x^2+1}$

```
f=double(2*pi*int(x*ds,1,2))
```

f = 30.8465

%The above equation is solved using formula : $\int_1^2 2\pi x.\mathrm{ds}$

```
%Volume of the curve
syms y x
x=sqrt(y)
```

x = $\sqrt{y}$

```
f=int(pi*y,1,4)
```

f =
$$\frac{15\pi}{2}$$

```
double(f)
```

ans = 23.5619

25.

```
syms x
y=sqrt(4-x^2)
```

y = $\sqrt{4-x^2}$

```
df=diff(y)
```

df =
$$-\frac{x}{\sqrt{4-x^2}}$$

```
ds=sqrt(1+((df)^2))
```

ds =
$$\sqrt{1-\frac{x^2}{x^2-4}}$$

```
Length=double(2*pi*int(y*ds,-1,1))
```

Length = 25.1327

```
%volume
syms y x
y=sqrt(4-x^2)
```

y = $\sqrt{4-x^2}$

```
f=int(pi*(y^2),-1,1)
```

f =
$$\frac{22\pi}{3}$$

```
double(f)
```

ans = 23.0383

26. : Use Trapezoidal rule to evaluate $\int_1^2 \frac{1}{x}\mathrm{dx}$ by taking n = 5.

```
f=@(x)(1./x);
a=1;
b=2;
n=5 %Number of intervals
```

n = 5

```
h=(b-a)/n %Increment
```

```
h = 0.2000
```

```
for i=1:n+1
    x=a+(i-1)*h %For generating x values
    y=f(x) % For y values
end
```

```
x = 1
y = 1
x = 1.2000
y = 0.8333
x = 1.4000
y = 0.7143
x = 1.6000
y = 0.6250
x = 1.8000
y = 0.5556
x = 2
y = 0.5000
```

```
T=(h/2)*((f(a)+2*sum(f(a+[1:n-1]*h))+f(b))); %Trapezoidal rule
Int_value=T
```

```
Int_value = 0.6956
```

27.

```
n=9;
a=0;
b=20;
h=2;
sum=0.0;
x=[2:2:20]
```

```
x = 1×10
     2     4     6     8    10    12    14    16    18    20
```

```
y=[10 18 25 29 32 20 11 5 2 0]
```

```
y = 1×10
    10    18    25    29    32    20    11     5     2     0
```

```
for i=1:n+1
    if(i==1 || i==n+1)
        sum=sum+y(i);
    else
        sum=sum+2*y(i);
    end
end
Distance_covered=sum*h/2
```

```
Distance_covered = 294
```

```
trapz(x,y)
```

```
ans = 294
```

28.

```
a=0;
b=1;
n=4;
h=(b-a)/n;
sum=0.0;
x=[0:0.25:1]
```

```
x = 1×5
        0    0.2500    0.5000    0.7500    1.0000
```

```
y=[1 0.9896 0.9589 0.9089 0.8415]
```

```
y = 1×5
    1.0000    0.9896    0.9589    0.9089    0.8415
```

```
y1=pi*y.^2
```

```
y1 = 1×5
    3.1416    3.0766    2.8887    2.5953    2.2246
```

```
for i=1:n+1
    if(i==1 || i==n+1)
        sum=sum+y1(i);
    else
        sum=sum+2*y1(i);
    end
end
volume_solid=sum*h/2
```

```
volume_solid = 2.8109
```

```
trapz(x,y1)
```

```
ans = 2.8109
```