Question no 1:

Program Assignment.

Example 1.1;

①

Input;

length, breadth, thickness.

Process;

$V = l \times b \times h$

Output

Volume.

②

Test Case;

→ If $l = 3m$, $b = 6m$, $h = 10m$.

$V = l \times b \times h$

$V = (3)(6)(10)$

$= 180m^3$

→ If $l = 1.5m$, $b = 2m$; $h = 4m$.

$V = l \times b \times h$

$= (1.5)(2)(4)$

$= 12m^3$.

③ Algorithm:

Variables

- ~~Input~~ length, breadth, thickness, Volume
- Output ("Enter length: ")
- Input length.
- Output ("Enter breadth: ")
- Input breadth.
- Output ("Enter thickness: ")
- Input thickness
- Volume = length x breadth x thickness
- Print Volume.

C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float length,breadth,thickness,volume;
cout<<"Enter length : ";
cin>>length;
cout<<"Enter breadth : ";
cin>>breadth;
cout<<"Enter thickness : ";
cin>>thickness;
volume=length*breadth*thickness;
cout<<"Your Volume : "<<volume;
}
```

Question no 2:

Example 1.2;

① Input;

Mass 1, Mass 2, Total Mass.

Process

TotalMass = Mass 1 + Mass 2

Output;

TotalMass.

② Test Case;

⇒ If Mass 1 = 2kg ; Mass 2 = 3kg

TotalMass = 2 + 3

= 5kg

⇒ If Mass 1 = 2.7kg ; Mass 2 = 3.3kg

Total Mass = 6 kg

③ Algorithm;

Variables

- ~~Input~~ Mass 1, Mass 2, Total Mass.
- Output ("Enter Mass : ")
- Input Mass 1.
- Output ("Enter Mass : ")
- Input Mass 2
- Total Mass = Mass 1 + Mass 2.
- Print Total Mass.

C++ Code :

```
#include <iostream>
using namespace std;
int main(){
float mass1,mass2,totalmass;
cout<<"Enter your mass : ";
cin>>mass1;
cout<<"Enter your mass : ";
cin>>mass2;
totalmass=mass1+mass2;
cout<<"Your total mass : "<<totalmass;
}
```

Question no 3:

Example 1.3;

① Input;

Diameter, length

Process;

$$V = \frac{\pi d^2 l}{4}$$

Output;

Volume (V).

② Test Case;

⇒ If Diamter = 2m
Length = 8m

$$V = \frac{\pi d^2 l}{4}$$

$$= \frac{(\pi)(4)(8)}{4}$$

$$= 8(3.14)$$

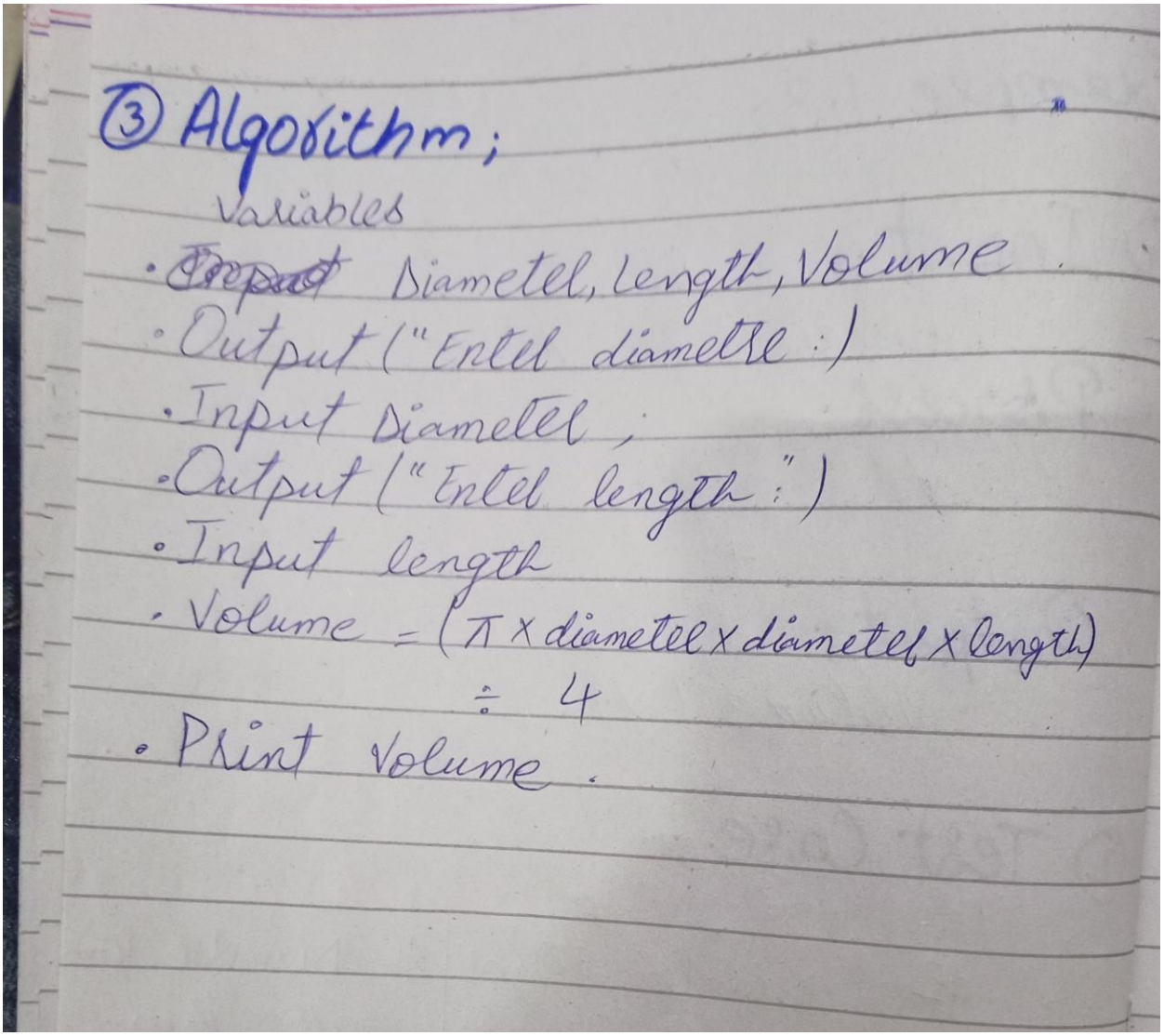
$$= 25.12 m^3$$

If Diametre = 1(
Length = 16m

$$V = \frac{(\pi)(100)^2(16)}{4}$$

$$= (400)(\pi)$$

$$= 1256 m^3.$$



C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float diameter,length,volume;
cout<<"Enter diameter : ";
cin>>diameter;
cout<<"Enter length : ";
cin>>length;
```

```
volume=(3.14*diameter*diameter*length) / 4;
cout<<"Your volume : "<<volume;
}
```

Question no 4:

Example 3.2;

① Input:

Velocity 1, Velocity 2, Mass, Time.

Process;

$$F = \frac{mv_f - mv_i}{t}$$

Output;

Force.

② Test Case;

=> If $m = 1000\,kg$

$v_f = 30\,ms^{-1}$

$v_i = 25\,ms^{-1}$

$t = 5\,sec.$

$$F = \frac{mv_f - mv_i}{t}$$

$$F = \frac{(1000)(30) - (1000)(25)}{5}$$

$$= \frac{30,000 - 25,000}{5}$$

$$= 1000N.$$

=> If $m = 500\,kg$

$v_f = 20\,ms^{-1}$

$v_i = 15\,ms^{-1}$

$t = 3\,sec.$

$$F = \frac{mv_f - mv_i}{t}$$

$$= \frac{(500)(20) - (500)(15)}{3}$$

$$= \frac{10,000 - 7500}{3}$$

$$= 833.3N.$$

③ Algorithm:

Variables

- Mass, Velocity 1, Velocity 2, Time, Force
- Output ("Enter Mass: ")
- Input Mass
- Output ("Enter Initial Velocity: ")
- Input Velocity 1
- Output ("Enter Final Velocity: ")
- Input Velocity 2
- Output ("Enter time: ")
- Input Time.
- Force = [(Mass) × (Velocity 2)] - [(Mass) × (Velocity 1)] ÷ Time.

C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float mass,velocity1,velocity2,time_,force;
cout<<"Enter Mass : ";
cin>>mass;
cout<<"Enter velocity : ";
cin>>velocity1;
cout<<"Enter velocity : ";
cin>>velocity2;
cout<<"Enter time : ";
cin>>time_;
force=((mass * velocity1)-(mass * velocity2)) / time_;
cout<<"Your force : "<<force;
}
```

Question no 5:

Example 3.4;

① Input;

Mass1, Mass 2, Velocity 1

Process;

$$v_1' = \frac{m_1 - m_2}{m_1 + m_2} v_1$$

Output:

Velocity.

② Test Case:

If $m_1 = 70g$, $m_2 = 100g$

$v_1 = 5 ms^{-1}$.

$$v_1' = \frac{70-100}{70+100} \times 5$$

$$= \frac{(-30)(5)}{170}$$

$$= \frac{-150}{170}$$

$$= -0.88 ms^{-1}$$

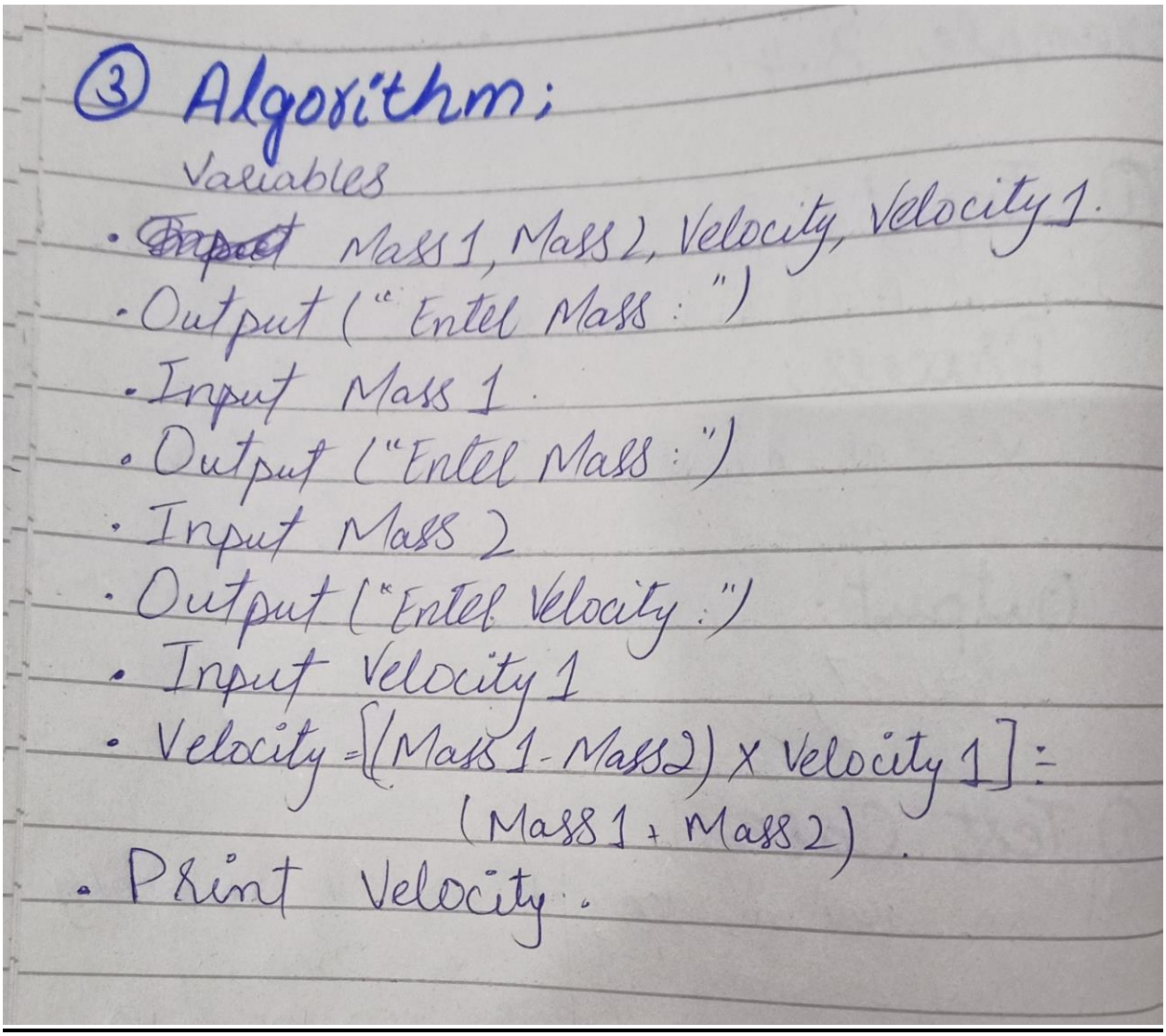
If $m_1 = 150kg$; $m_2 = 100kg$

$v_1 = 10 ms^{-1}$.

$$v_1' = \frac{150-100}{150+100} \times 10$$

$$= \frac{50}{250} \times 10$$

$$= 2 ms^{-1}.$$



C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float mass1,mass2,velocity,velocity1;
cout<<"Enter your mass : ";
cin>>mass1;
cout<<"Enter your mass : ";
cin>>mass2;
cout<<"Enter your velocity : ";
```

```
cin>>velocity1;
velocity=((mass1-mass2)*velocity1)/(mass1+mass2);
cout<<"Your velocity : "<<velocity;
}
```

Question no 6:

Example 3.5;

① **Input;**

Mass 1, Mass 2, Velocity 1.

Process;

$$v_2' = \frac{2m_1}{m_1 + m_2} v_1$$

Output;

Velocity.

② **Test Case;**

If $m_1 = 10\,kg$

$m_2 = 5\,kg$

$v_1 = 10\,ms^{-1}$.

$$v_2' = \frac{(2)(10)(10)}{(10+5)}$$

$$= 13.33\,ms^{-1}$$

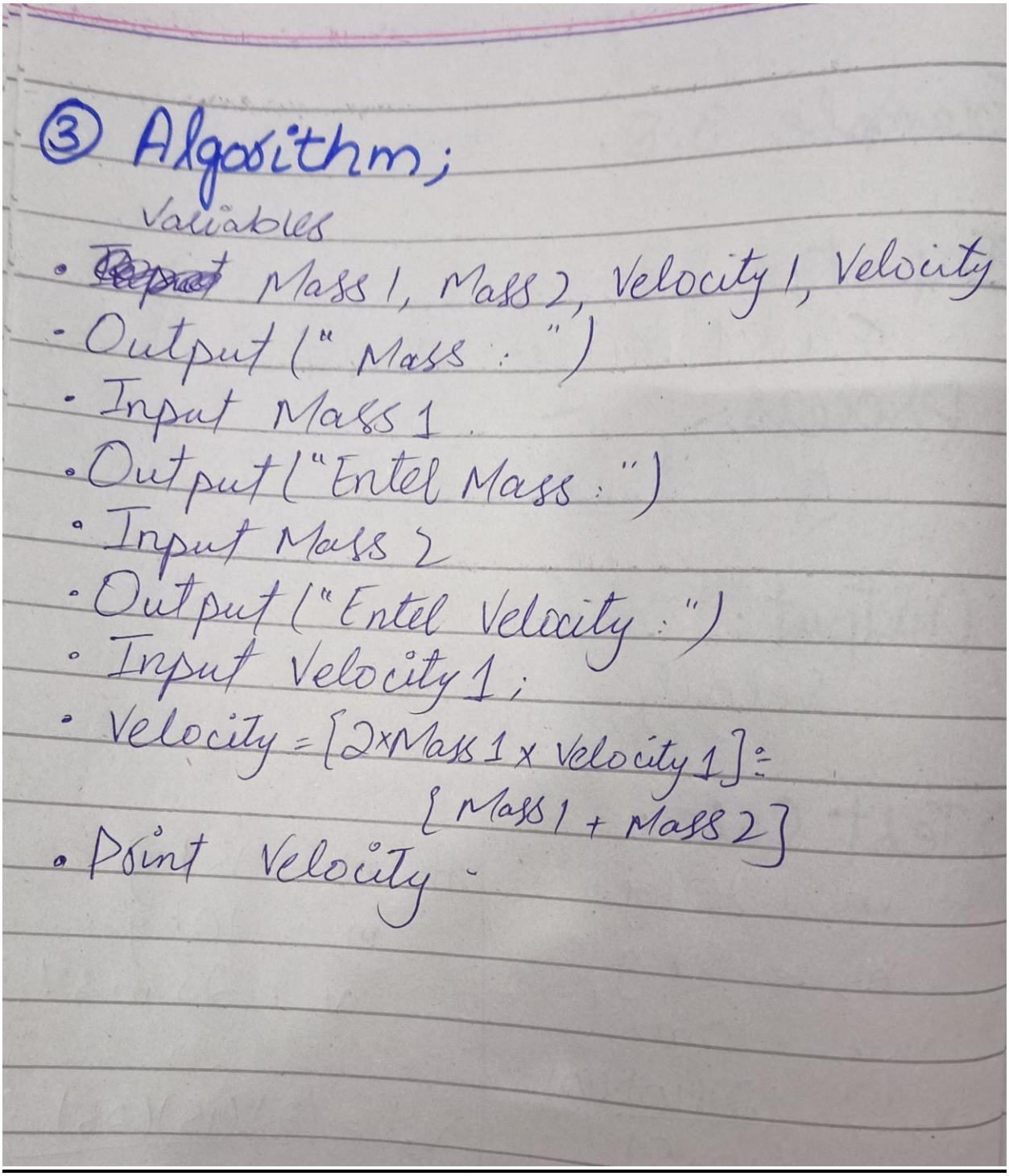
If $m_1 = 15\,kg$

$m_2 = 10\,kg$

$v_1 = 25\,ms^{-1}$.

$$v_2' = \frac{(2)(15)(25)}{15+10}$$

$$= 30\,ms^{-1}.$$



C++ Code :

```
#include <iostream>

using namespace std;

int main(){
```

```
float mass1,mass2,velocity1,velocity;
cout<<"Enter mass : ";
cin>>masss1;
cout<<"Enter mass : ";
cin>>masss2;
cout<<"Enter velocity : ";
cin>>velocity1;
velocity=(2*mass1*velocity1)/(mass1+mass2);
cout<<"Your velocity : "<<velocity;
}
```

Question no 7:

Example 4.2 :-

① **Input;**

Mass, Height, Time.

Process:

$$P = \frac{mgh}{t}$$

Output:

Power.

② **Test cases;**

If $m = 10\,kg$, $t = 5\,sec$, $h = 5\,m$.

$$\text{Power} = \frac{mgh}{t}$$

$$= \frac{(10)(9.8)(5)}{(5)}$$

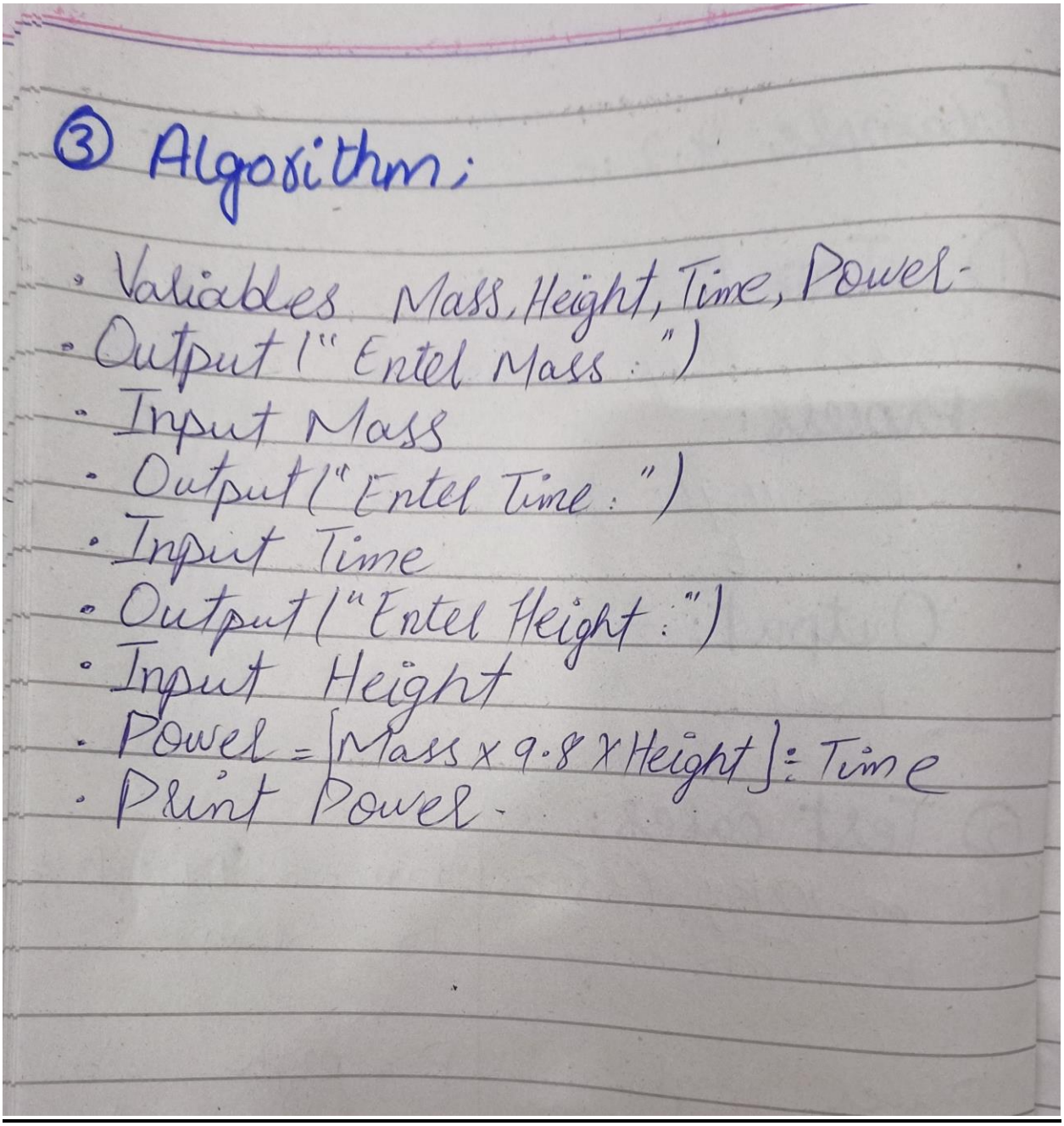
$$= 98\,W$$

If $m = 2.5\,kg$, $t = 10\,sec$, $h = 50\,m$.

$$P = \frac{mgh}{t}$$

$$= \frac{(2.5)(9.8)(50)}{10}$$

$$= 122.5\,W.$$



C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float mass,height,time,power;
cout<<"Enter mass : ";
```

```
cin>>mass;
cout<<"Enter height : ";
cin>>height;
cout<<"Enter time : ";
cin>>time;
power=(mass*9.8*height) / time;
cout<<"Your power : "<<power;
}
```

Question no 8:

Example 4.3:

① **Input:**

Mass, Height 1, Height 2.

Process:

$$mg(h_1 - h_2) = \frac{1}{2} m(v_2^2 - v_1^2)$$

OR

$$v = \sqrt{2g(h_1 - h_2)}$$

Output:

Velocity.

② **Test Case:**

If $h_1 = 10m, h_2 = 3m$

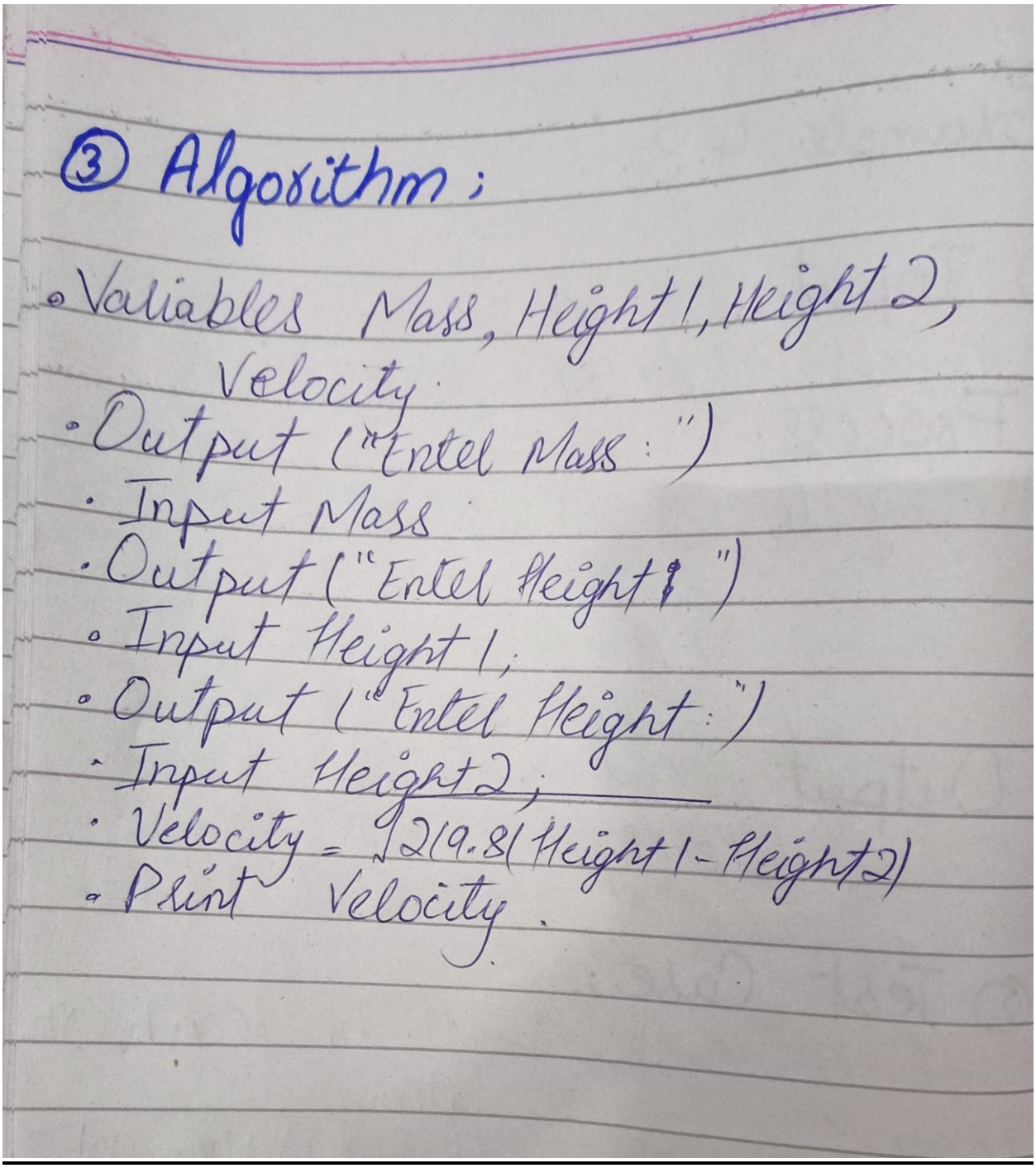
then;

$$v = \sqrt{2g(10-3)}$$
$$= \sqrt{(2)(7)(9.8)}$$
$$= 11.7 ms^{-1}$$

If $h_1 = 100m, h_2 = 50m$

then;

$$v = \sqrt{2(9.8)(100-50)}$$
$$= \sqrt{980}$$
$$= 31.30 ms^{-1}.$$



C++ Code:

```
#include <iostream>
#include <cmath>
using namespace std;
int main(){
```

```
float mass,height1,height2,velocity;
cout<<"Enter your mass : ";
cin>>mass;
cout<<"Enter your height : ";
cin>>height1;
cout<<"Enter your height : ";
cin>>height2;
velocity=sqrt(2*9.8*(height1-height2));
cout<<"Your Velocity : "<<velocity;
}
```

Question no 9:

Example 5.2:

① Input:
Mass, Velocity, Radius
Process:
$$F = \frac{mv^2}{r}$$
Output:
Force.

② Test Case;

If $m = 2kg$; $v = 5ms^{-1}$
$r = 25m$.

$$F = \frac{mv^2}{r}$$
$$= \frac{(2)(5)^2}{25}$$
$$= 2N$$

If $m = 10kg$; $v = 7ms^{-1}$
$r = 14m$.

$$F = \frac{mv^2}{r}$$
$$= \frac{(10)(49)}{14}$$
$$= 35N.$$

C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float mass,velocity,radius,force;
cout<<"Enter mass : ";
cin>>mass;
cout<<"Enter velocity : ";
cin>>velocity;
cout<<"Enter radius : ";
cin>>radius;
force=(mass*velocity*velocity)/radius;
cout<<"Your force : "<<force;
}
```

Question no 10:

Example 5.4.

① **Input;**

Mass, Radius, Time

Process;

$$L_0 = \frac{2\pi l^2 m}{T}$$

Output;

Momentum

② **Test Case;**

If $m = 10\,kg$, $l = 5m$

$T = 10\,sec$.

$$L_0 = \frac{(2\pi)(25)(10)}{10}$$

$$= 157\ kgm^2s^{-1}$$

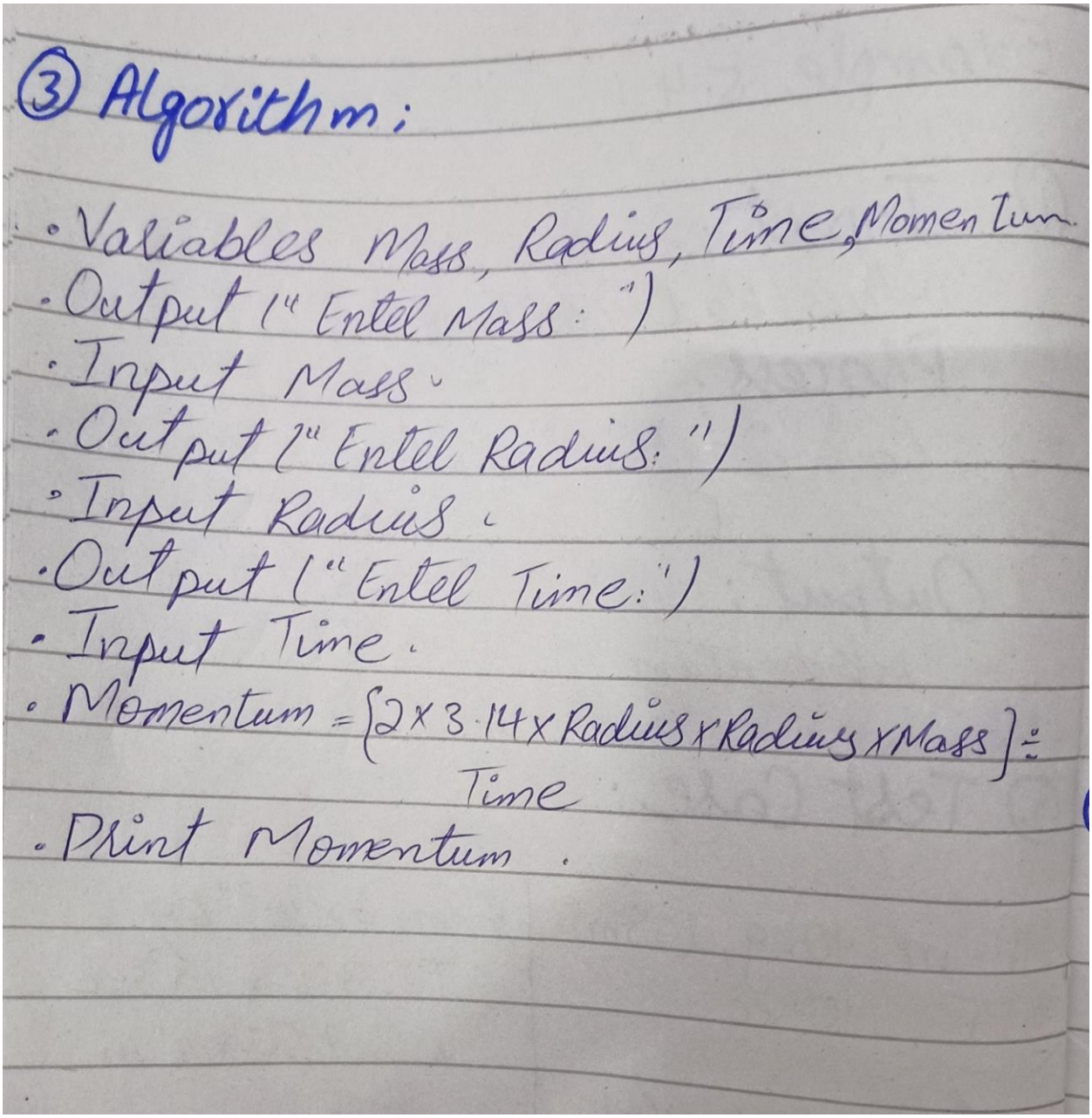
If $m = 6 \times 10^{24}\,kg$

$T = 3.16 \times 10^7\,sec$

$l = 1.50 \times 10^{11}\,m$

$$L_0 = \frac{2\pi (1.50 \times 10^{11})^2 (6 \times 10^{24})}{3.16 \times 10^7}$$

$$L_0 = 2.67 \times 10^{40}\ kgm^2s^{-1}.$$



C++ Code:

```
#include <iostream>
using namespace std;
int main(){
float mass,radius,time_,momentum;
cout<<"Enter mass : ";
```

```
cin>>mass;
cout<<"Enter radius : ";
cin>>radius;
cout<<"Enter time : ";
cin>>time;
momentum=(2*3.14*radius*radius*mass)/time_;
cout<<"Your angular momentum : "<<momentum;
}
```

Question no 11:

Example 6.1;

① **Input;**

Radius, Density, η

Process;

$$v = \frac{2gs^2\rho}{\eta}$$

Output

Velocity.

② **Test Case;**

If $s = 10m$

$\rho = 1000 kgm^{-3}$

$\eta = 19 \times 10^{-6} kgm^{-1}s^{-1}$.

$$v = \frac{(2)(9.8)(10)^2(1000)}{19 \times 10^{-6}}$$

$$= 1.0 \times 10^{11} ms^{-1}$$

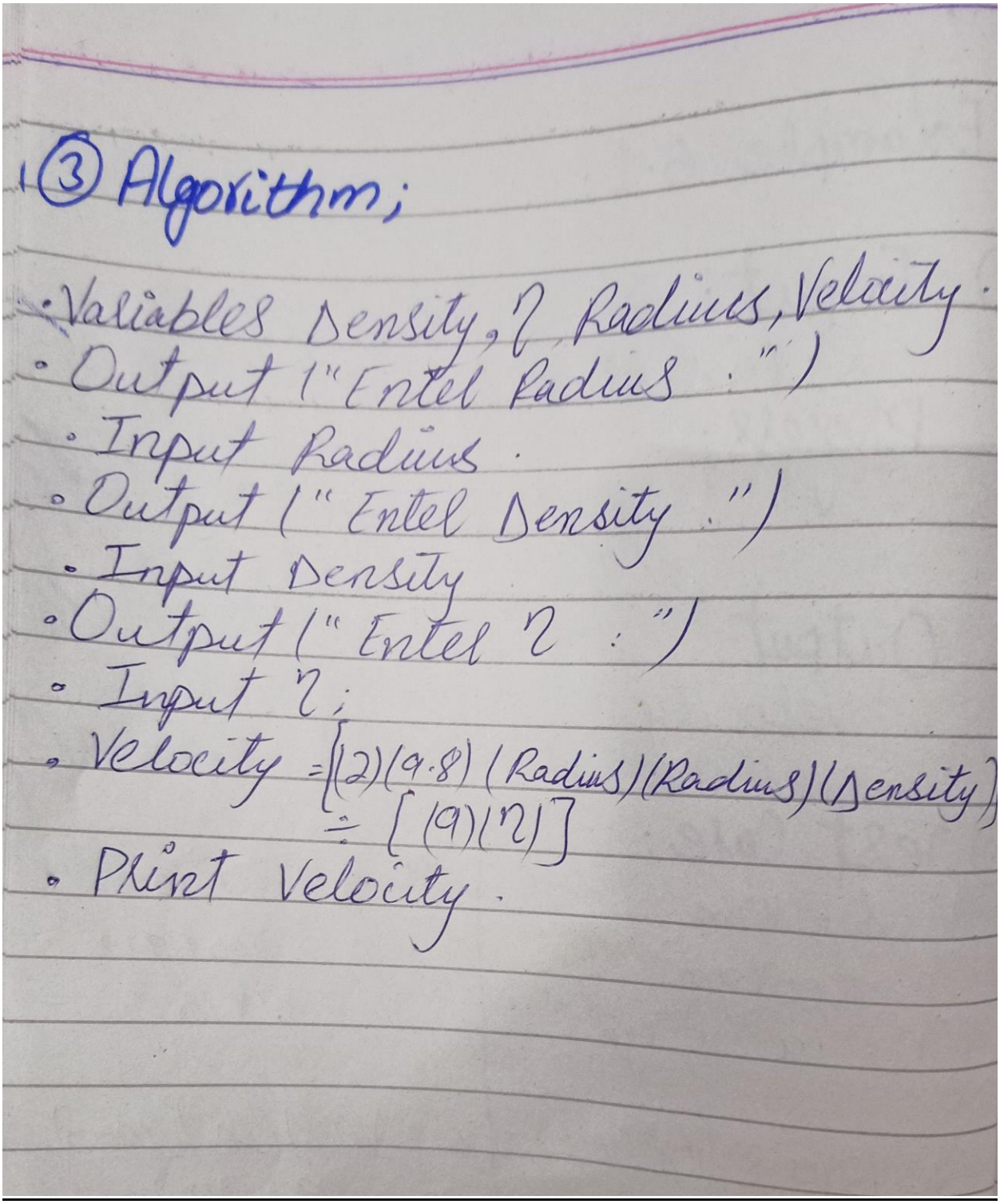
If $s = 10^{-2}m$

$\rho = 1200 kgm^{-3}$

$\eta = 19 \times 10^{-6}$

$$v = \frac{(2)(9.8)(10^{-2})^2(1000)}{19 \times 10^{-6}}$$

$$= 103157.8 ms^{-1}.$$



C++ Code:

```
#include <iostream>

using namespace std;
```

```
int main(){
 float density,n,radius,velocity;
 cout<<"Enter density : ";
 cin>>density;
 cout<<"Enter value of n : ";
 cin>>n;
 cout<<"Enter radius : ";
 cin>>radius;
 velocity=(2*9.8*radius*radius*density)/(9*n);
 cout<<"Your velocity : "<<velocity;
}
```

Question no 12:

Example 6.2;

① **Input;**
Radius, Mass, Time, Density

Process;

$$V = \frac{\text{mass}}{\text{second}} \Big/ \rho A$$

Output;
Velocity.

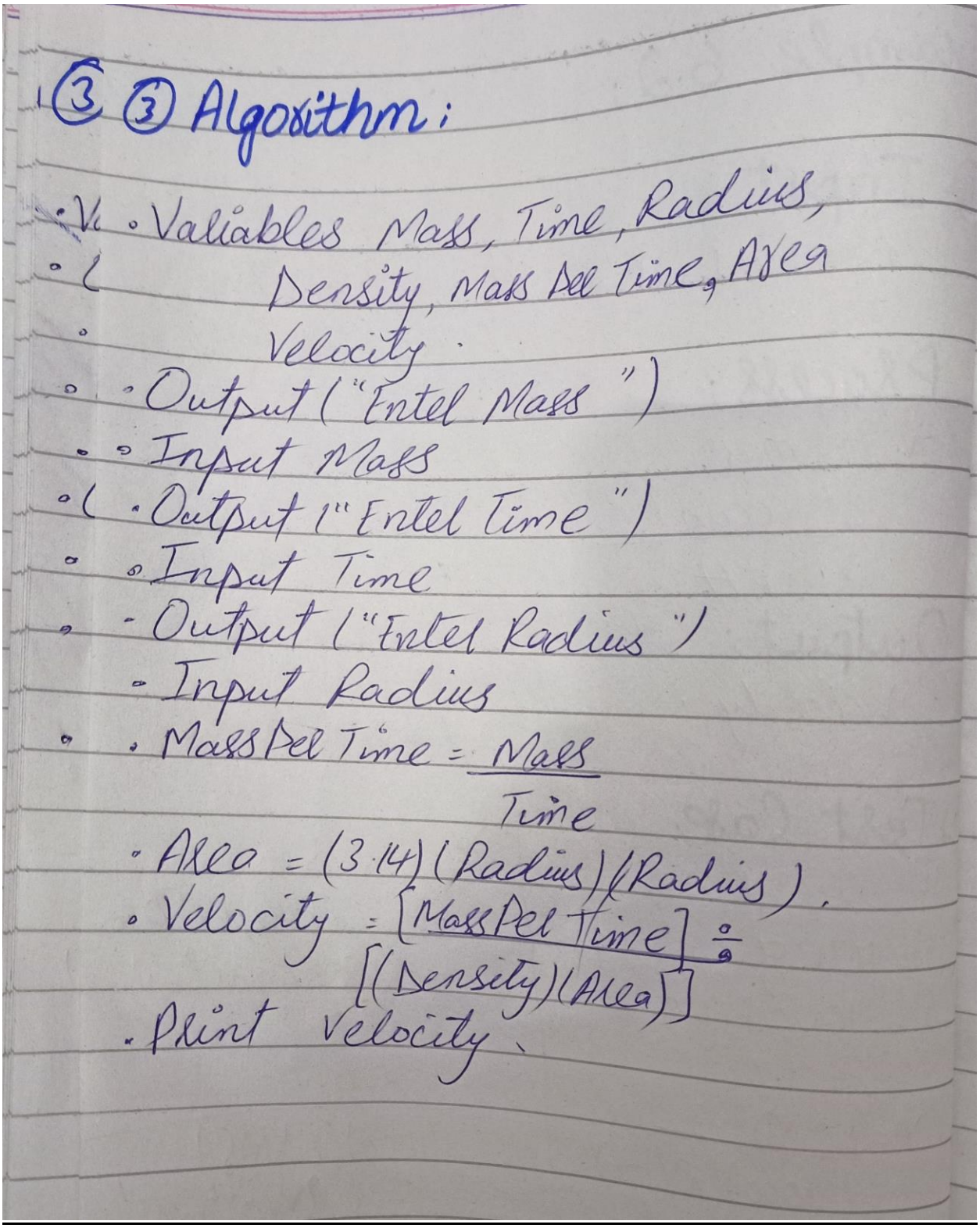
② **Test Case**

If $l = 10m$
$m = 10kg, t = 5sec$
$\rho = 1000 kgm^{-3}$

$$V = \frac{2}{(1000)(\pi)(100)}$$
$$V = 6.3 \times 10^{-6} ms^{-1}$$

If $l = 5m$
$m = 20kg, t = 50se$
$\rho = 1000 kgm^{-3}$.

$$V = \frac{0.4}{(1000)(\pi)(125)}$$
$$= 5.09 \times 10^{-6} ms^{-1}$$



C++ Code:

```
#include <iostream>
```

```
using namespace std;
int main(){
float mass,time,radius,density,masspertime,area,velocity;
cout<<"Enter mass : ";
cin>>mass;
cout<<"Enter time : ";
cin>>time;
cout<<"Enter mass : ";
cin>>radius;
cout<<"Enter density : ";
cin>>density;
masspertime=mass/time;
area=3.14*radius*radius;
velocity=masspertime/(density*area);
cout<<"Your velocity : "<<velocity;
}
```

Question no 13:

Example 7.1

① Input;

Mass1 x Mass2

Process

$$T = 2\pi\sqrt{\frac{m}{K}}$$

Output

Time

② Test Case:

If $m_1 = 5kg$

$x = 2m$

$m_2 = 0.5kg$

$$T = 2\pi\sqrt{\frac{m}{K}}$$

$$= (2)(3.14)\sqrt{\frac{0.5}{24.5}}$$

$$= 0.89 \text{ sec}$$

If $m_1 = 10kg$

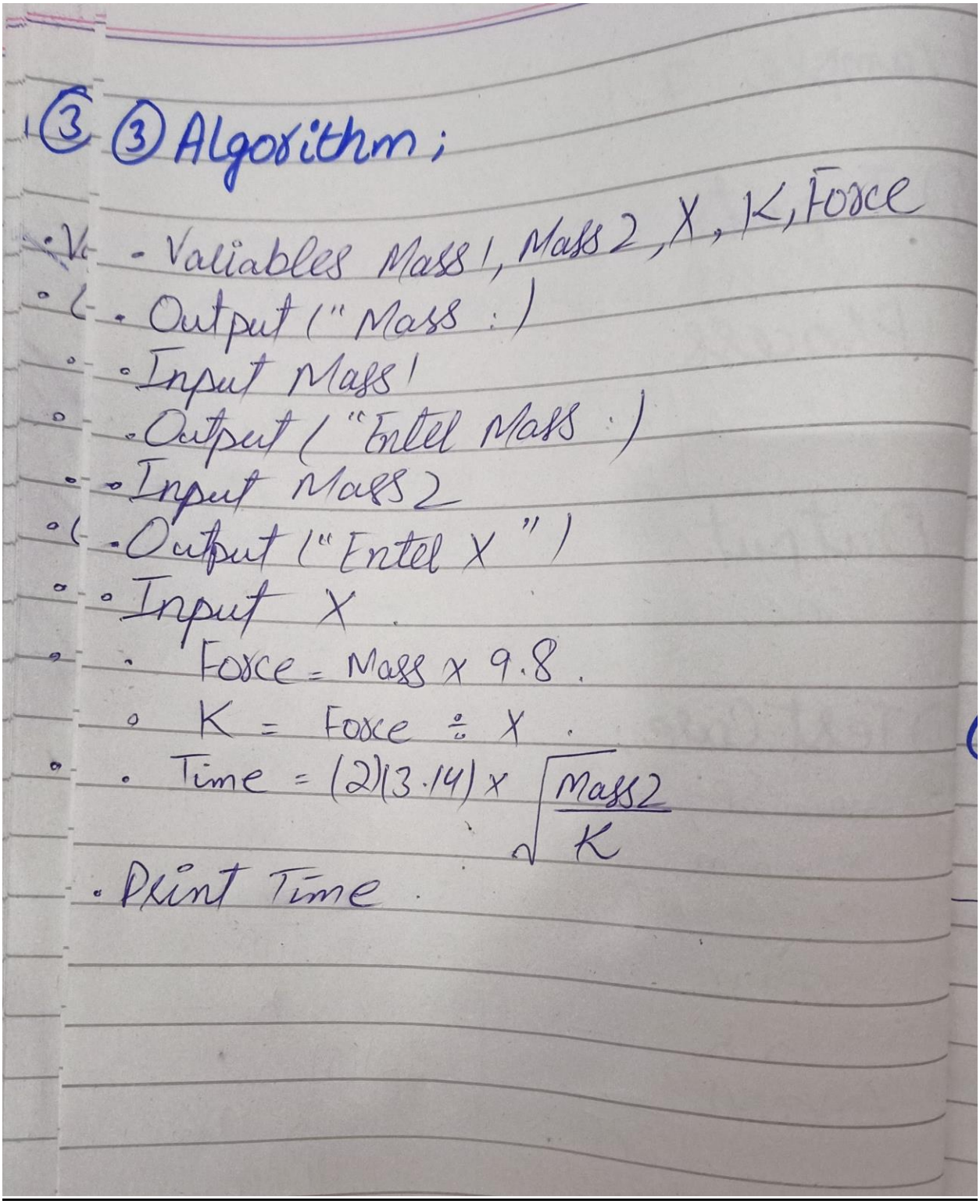
$x = 5m$

$m_2 = 1kg$

$$T = 2\pi\sqrt{\frac{m}{K}}$$

$$= (2)(\pi)\sqrt{\frac{1}{19.6}}$$

$$= 1.41 \text{ sec.}$$



C++ Code:

```
#include <iostream>
#include <cmath>
```

```
using namespace std;
int main(){
float mass1,mass2,x,k,force,time_;
cout<<"Enter mass : ";
cin>>mass1;
cout<<"Enter released mass : ";
cin>>mass2;
cout<<"Enter value of x : ";
cin>>x;
force=9.8*mass1;
k=force*x;
time_=2*3.14*sqrt(mass2/k);
cout<<"Your time : "<<time_;
}
```

Question no 14:

• Example 7.2

① Input:

Time =

Process:

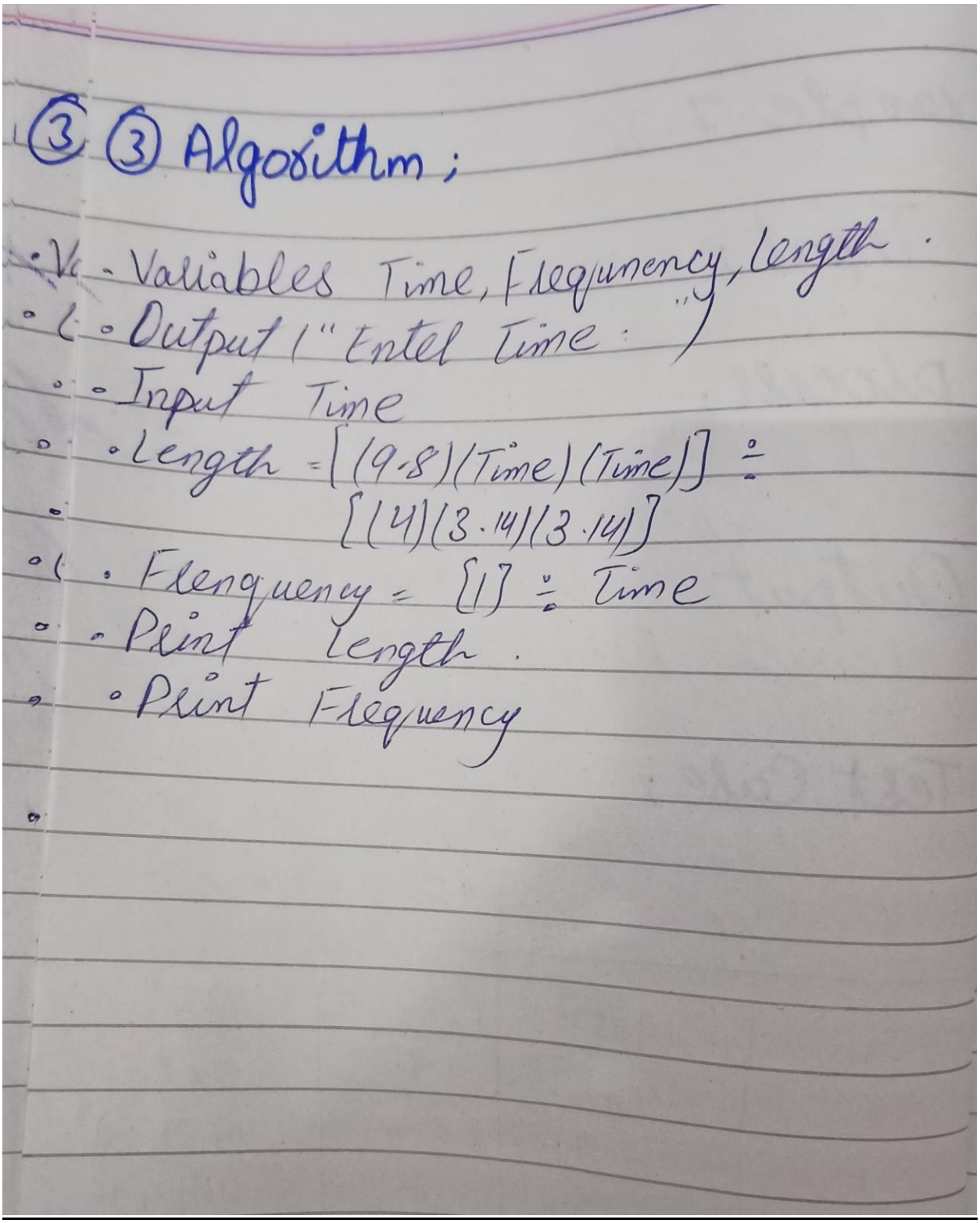
$l = \frac{gT^2}{4\pi^2}$, $f = \frac{1}{T}$

Output

Length, Frequency.

② Test Case;

If T = 5sec.		If T = 10sec	
$f = \frac{1}{T}$	$l = \frac{(9)(5)^2}{4\pi^2}$	$f = \frac{1}{T}$	$l = \frac{gT^2}{4\pi^2}$
$f = \frac{1}{5}$	$= 6.2m$	$f = \frac{1}{10}$	$= \frac{(9.8)(10)^2}{(4)(\pi)^2}$
$f = 0.2Hz$		$f = 0.1Hz$	$= 24.82m$



C++ Code:

```
#include <iostream>
```

```
using namespace std;
int main(){
float time_,frequency,length;
cout<<"Enter time period : ";
cin>>time_;
length=(9.8*time_*time_)/(4*3.14*3.14);
frequency=1/time_;
cout<<"Your Frequency : "<<frequency<<endl;
cout<<"Your Length : "<<length<<endl;
}
```

Question no 15:

Example 5.1;

① **Input;**

velocity 1, velocity 2, Time.

Process;

$\alpha = \frac{\omega_f - \omega_i}{t}$, $\theta = \omega_i t + \frac{1}{2}\alpha t^2$

Output;

Acceleration, Displacement

② **Test Case;**

If $\omega_f = 5 rev s^{-1}$
$\omega_i = 2 rev s^{-1}$
$t = 5 sec$

$\alpha = \frac{5-2}{5} \Rightarrow \frac{3}{5} rev\ s^{-2}$

$\theta = (2)(5) + \frac{1}{2}\left(\frac{3}{5}\right)(25)$

$= 10 + 7.5$

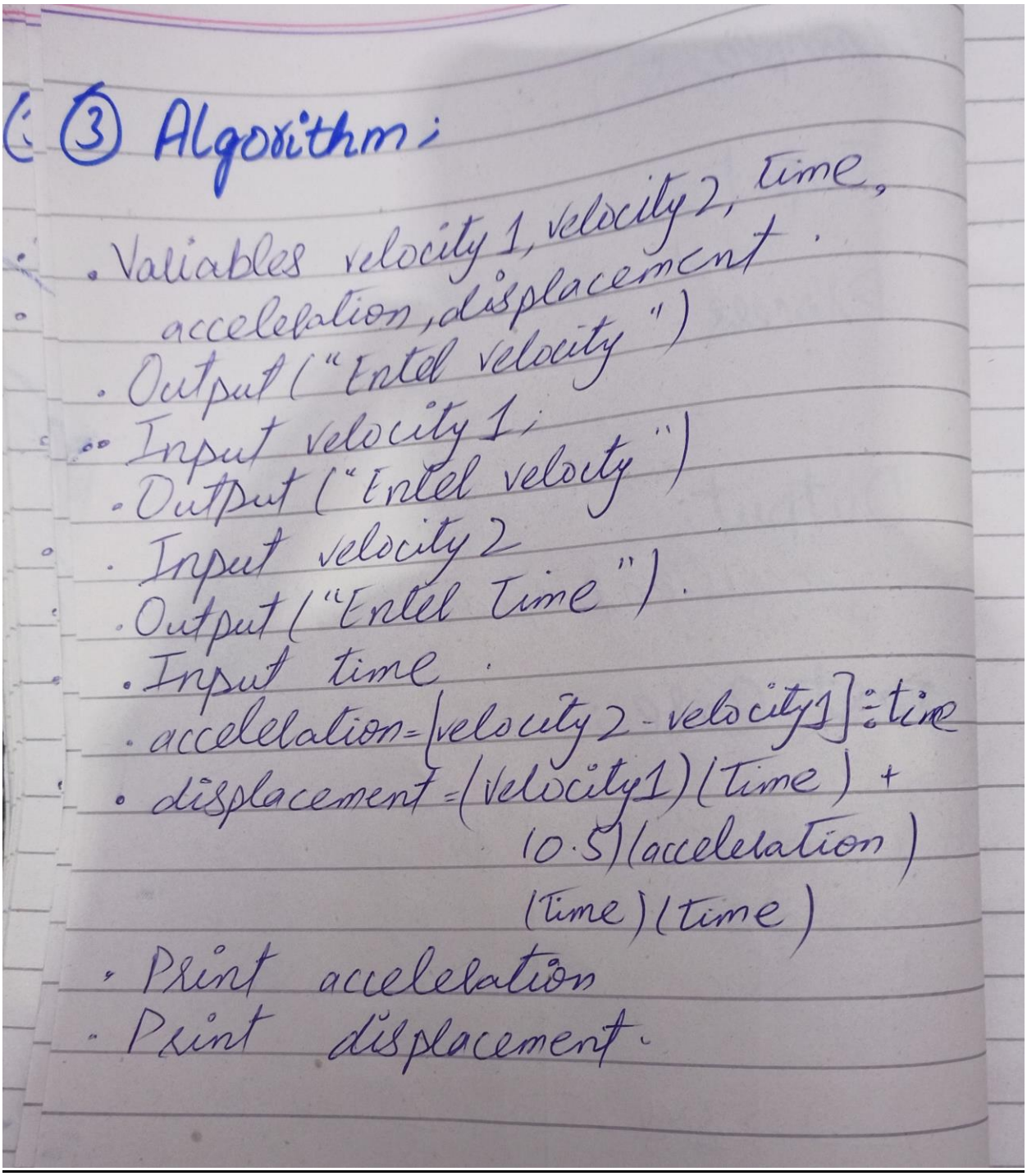
$= 17.5 rev$

If $\omega_f = 10 rev\ s^{-1}$
$\omega_i = 0 rev\ s^{-1}$.
$t = 5 sec$

$\alpha = \frac{10}{5} \Rightarrow 2 rev\ s^{-2}$.

$\theta = (5)(10) + \frac{1}{2}(2)(5)^2$

$= 25 rev.$



C++ Code:

```
#include <iostream>

using namespace std;

int main(){

float velocity1,velocity2,time_,acceleration,displacement;
```

```
cout<<"Enter velocity : ";
cin>>velocity1;
cout<<"Enter velocity : ";
cin>>velocity2;
cout<<"Enter time : ";
cin>>time_;
acceleration=(velocity2-velocity1)/time_;
displacement=velocity1*time_+(0.5*acceleration*time_*time_);
cout<<"Your angular displacement : "<<displacement;
cout<<"Your angular acceleration : "<<acceleration;
}
```