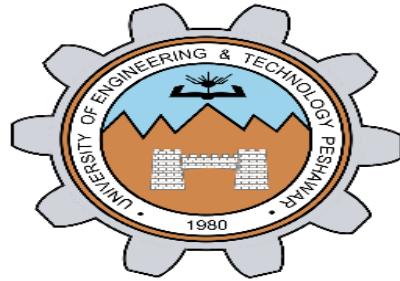


Lab report no 2



Fall 2021

Digital Signal Processing Lab

Submitted by:

Name: Muhammad Ali

Reg.no: 19pwcse1801

Section: A

Date: 26,11,2021

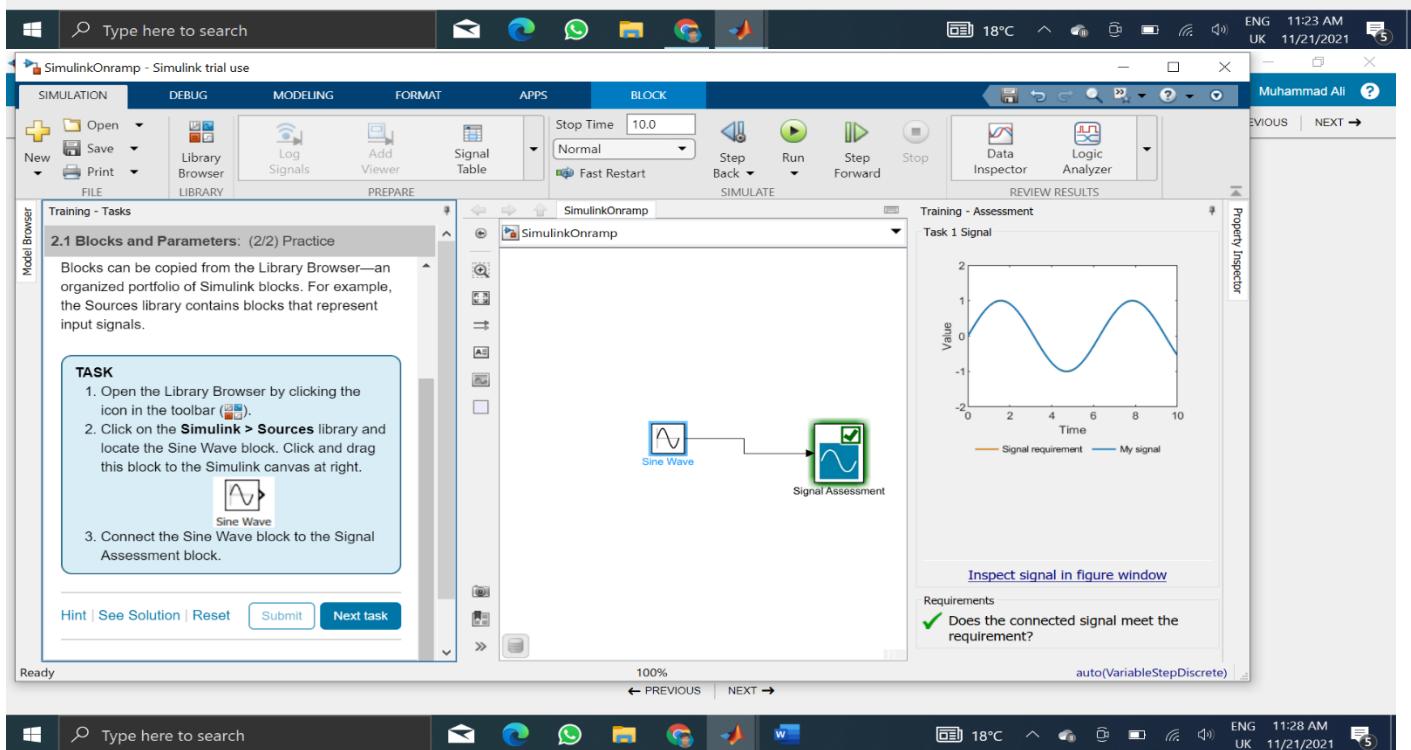
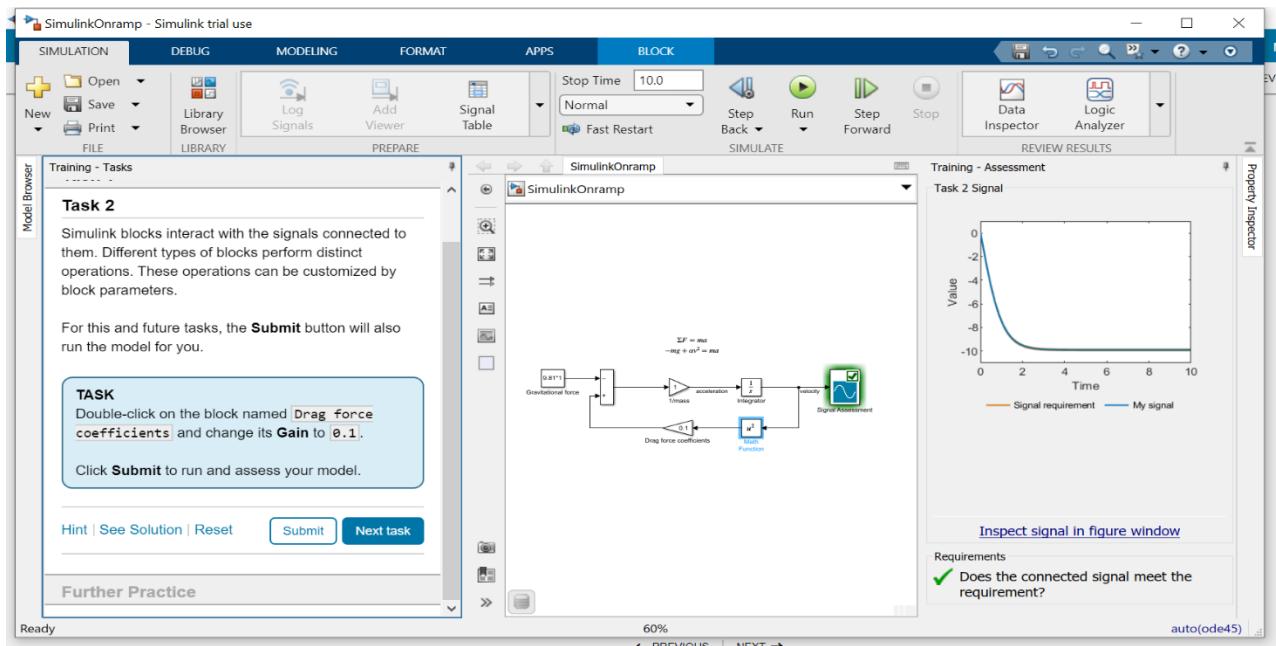
Submitted to:

Engr. Ihsan Ulhaq

Department of Computer Systems Engineering

University of Engineering and Technology, Peshawar

Changing gain value: -



SimulinkOnramp - Simulink trial use

SIMULATION **DEBUG** **MODELING** **FORMAT** **APPS** **BLOCK**

FILE **LIBRARY** **PREPARE**

Training - Tasks

Next, you will multiply v^2 by α . You can do this using the Gain block, which multiplies the incoming signal by a specified value.

Blocks with both one input and one output port will be automatically connected when dropped on an existing signal line.

TASK

1. Use the Quick Insert menu to add a Gain block from the **Simulink > Math Operations** library. (Activate the Quick Insert menu by double-clicking where you want to add a block and typing a block name.)
2. Set the **Gain** parameter to **0.05**.
3. Drag this onto the signal line connected to the **output** of the Math Function block. Both ports of the Gain block will automatically connect.

Hint | See Solution | Reset **Submit** **Next task**

REVIEW RESULTS

Training - Assessment

Task 3 Signal

Inspect signal in figure window

Requirements

✓ Does the connected signal meet the requirement?

auto(VariableStepDiscrete)

SimulinkOnramp - Simulink trial use

SIMULATION **DEBUG** **MODELING** **FORMAT** **APPS**

FILE **LIBRARY** **PREPARE**

Training - Tasks

the car. A unit step (a function whose value goes from 0 to 1 at a specified time) is a common test input for such a system.

In Simulink, the Step block provides a unit step at $t=1$ by default.

TASK

Add a Step block from the **Simulink > Sources** library and connect it to the unconnected signal labeled **reference**. Double-click on the block to see that the default **Step time** is **1**.

Connect the model output, **velocity**, to the Signal Assessment block.

Hint | See Solution | Reset **Submit** **Next task**

REVIEW RESULTS

Training - Assessment

Task 1 Signal

Inspect signal in figure window

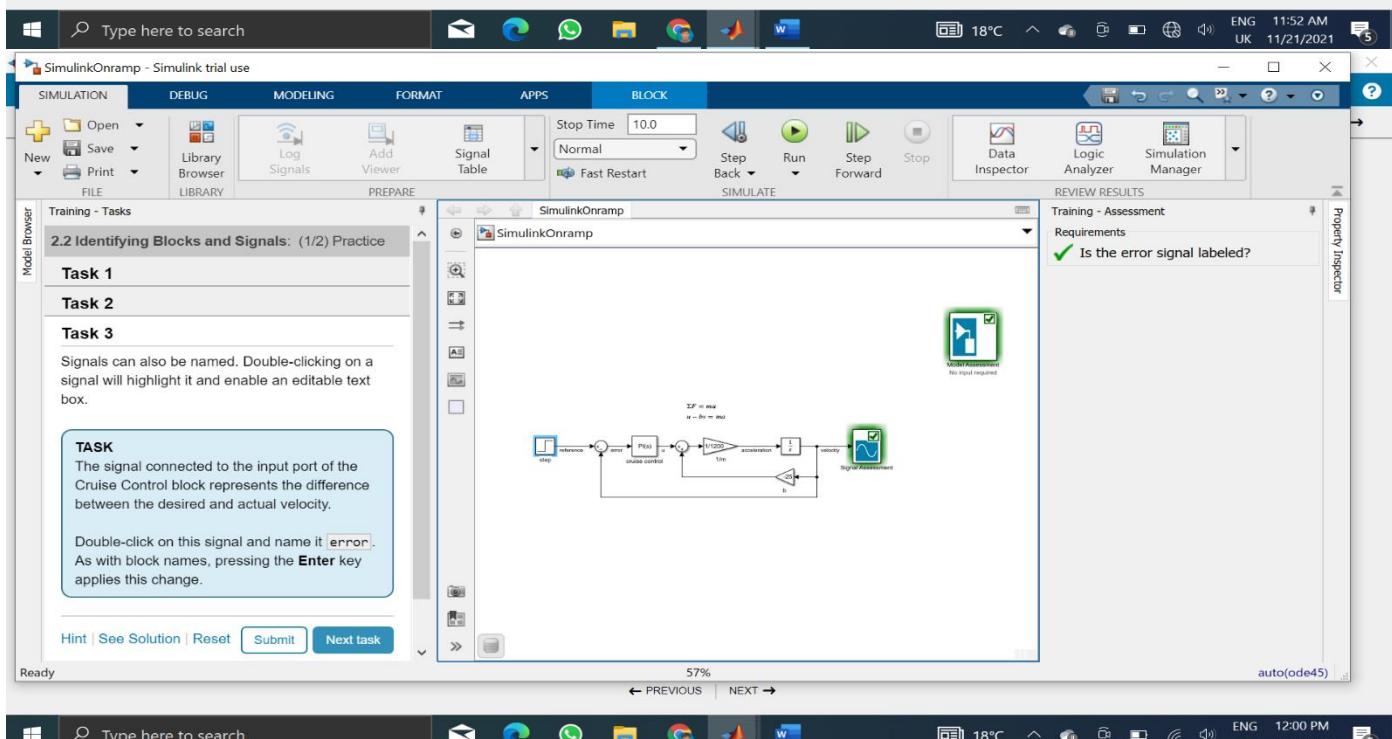
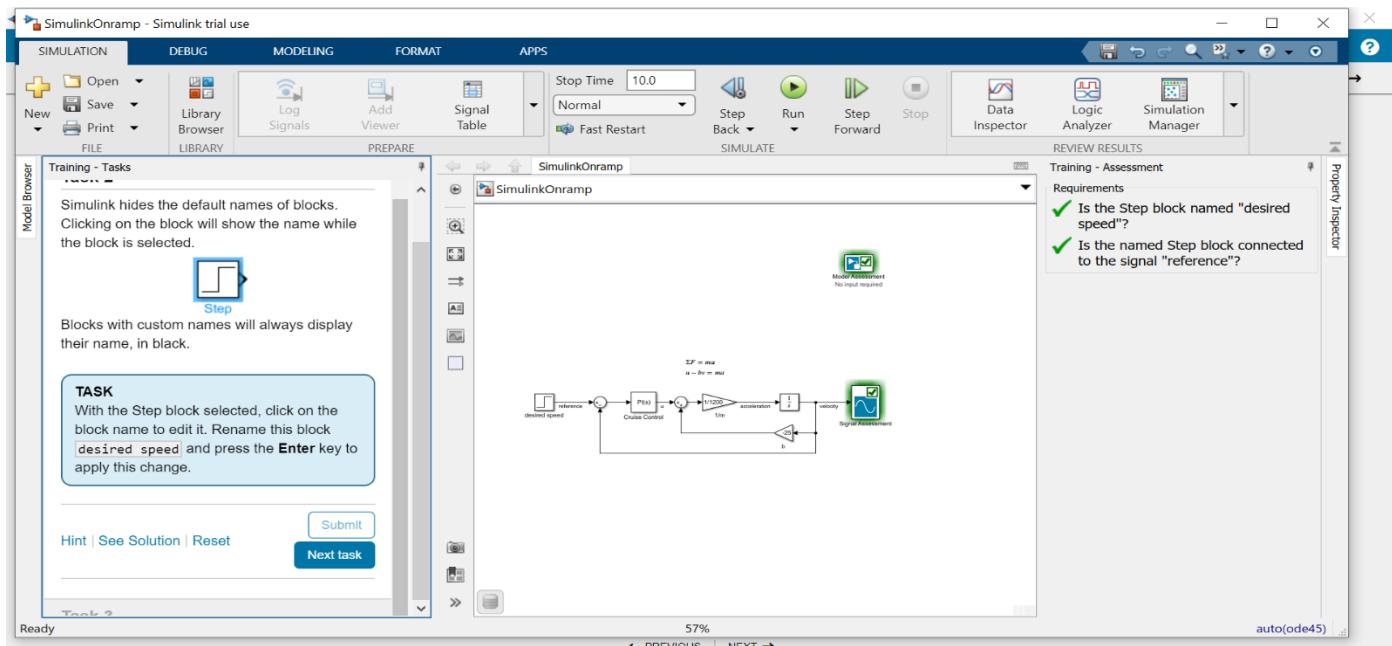
Requirements

✓ Does the connected signal meet the requirement?

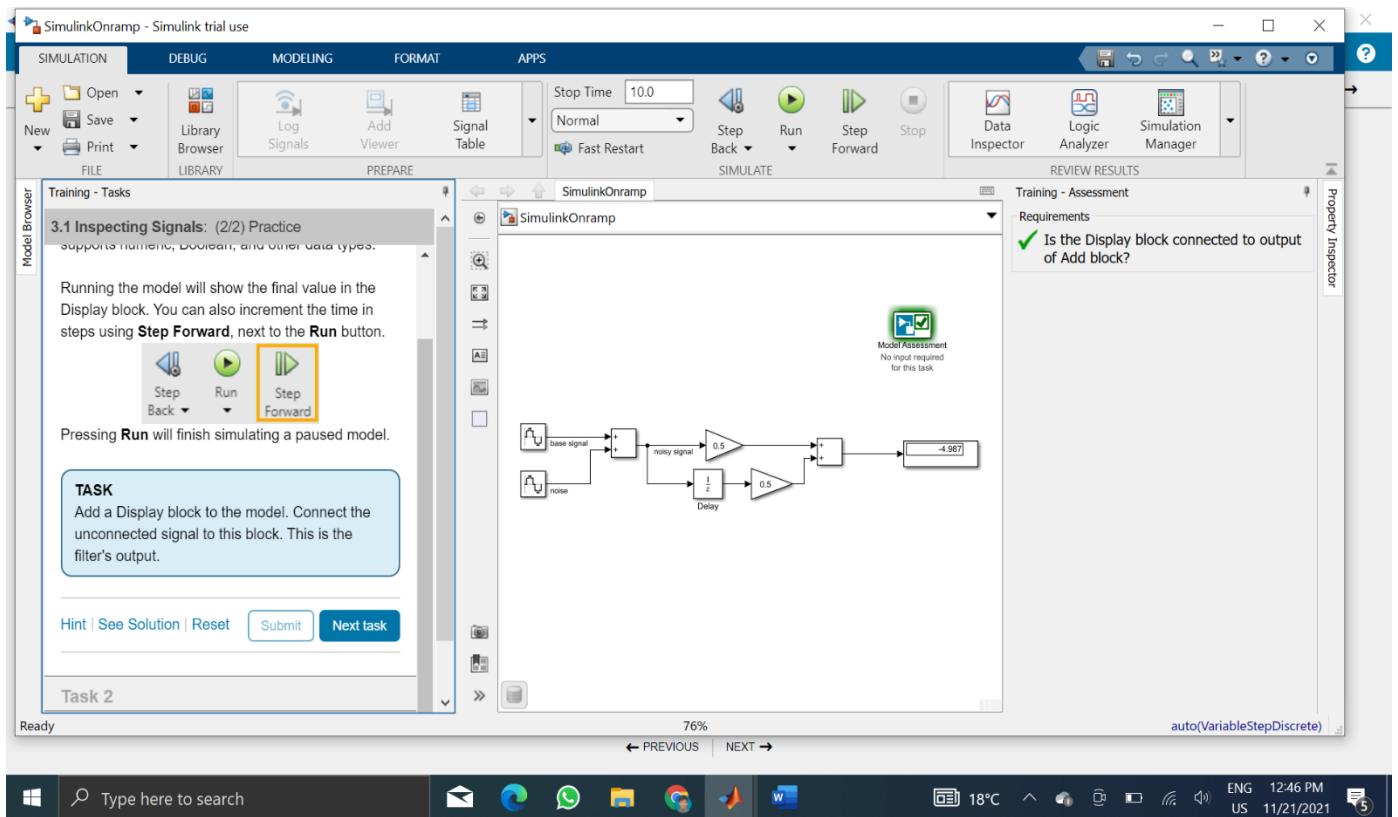
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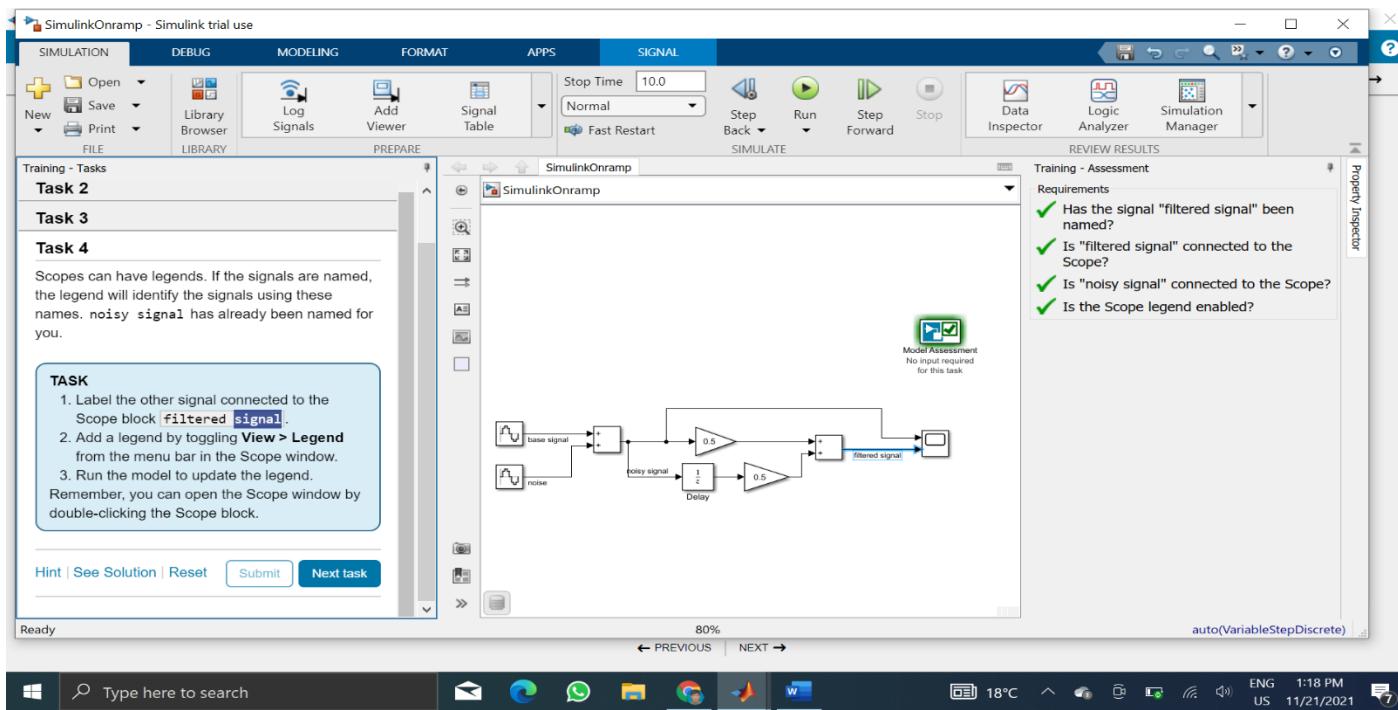
Renaming block name: -



Display value: -



Scope value: -



Square root of RAM signal (math operation): -

Training - Tasks

4.1 Mathematical Operators

with a constant slope, as specified by a block parameter. This ramp has a slope of 2, i.e. $u(t) = 2t$.

TASK

Compute the square root of the ramp signal, $u(t)$, by adding the Square Root block (Sqrt) from the **Simulink > Math Operations** library to the model.

Connect the signals such that the Signal Assessment block receives the signal $\sqrt{2t}$.

Hint | See Solution | Reset **Submit** **Next task**

Training - Assessment

Task 1 Signal

Value

Time

Signal requirement: My signal:

Inspect signal in figure window

Requirements

✓ Does the connected signal meet the **auto(VariableStepDiscrete)**

Training - Tasks

In addition to time-varying sources like the Sine Wave and Ramp blocks, Simulink contains a constant source.

TASK

Add a Constant block (**Simulink > Sources**) to the model. Change its **Constant value** to 3 and connect it to the new Signal Assessment block.

Hint | See Solution | Reset **Submit** **Next task**

Task 3

Task 4

Further Practice

Training - Assessment

Task 2 Signal

Value

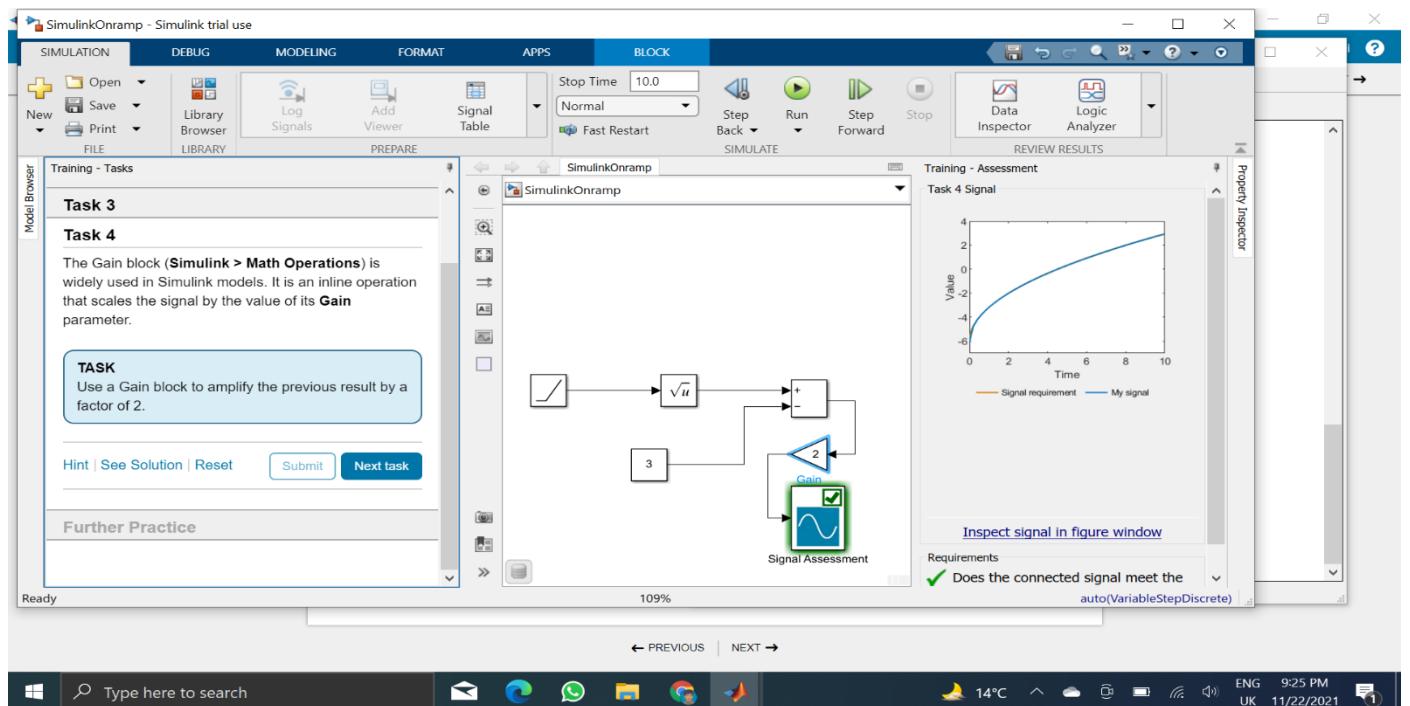
Time

Signal requirement: My signal:

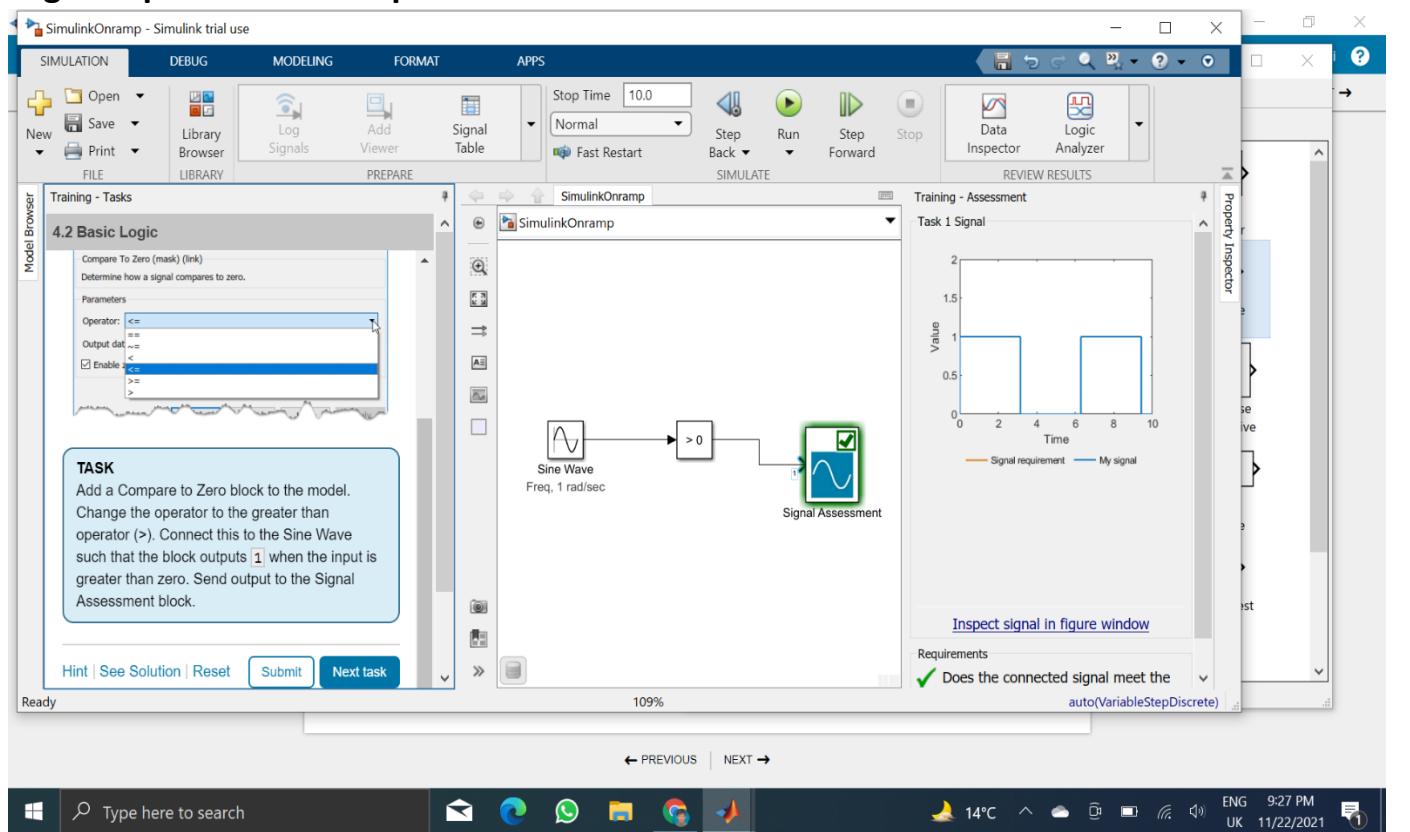
Inspect signal in figure window

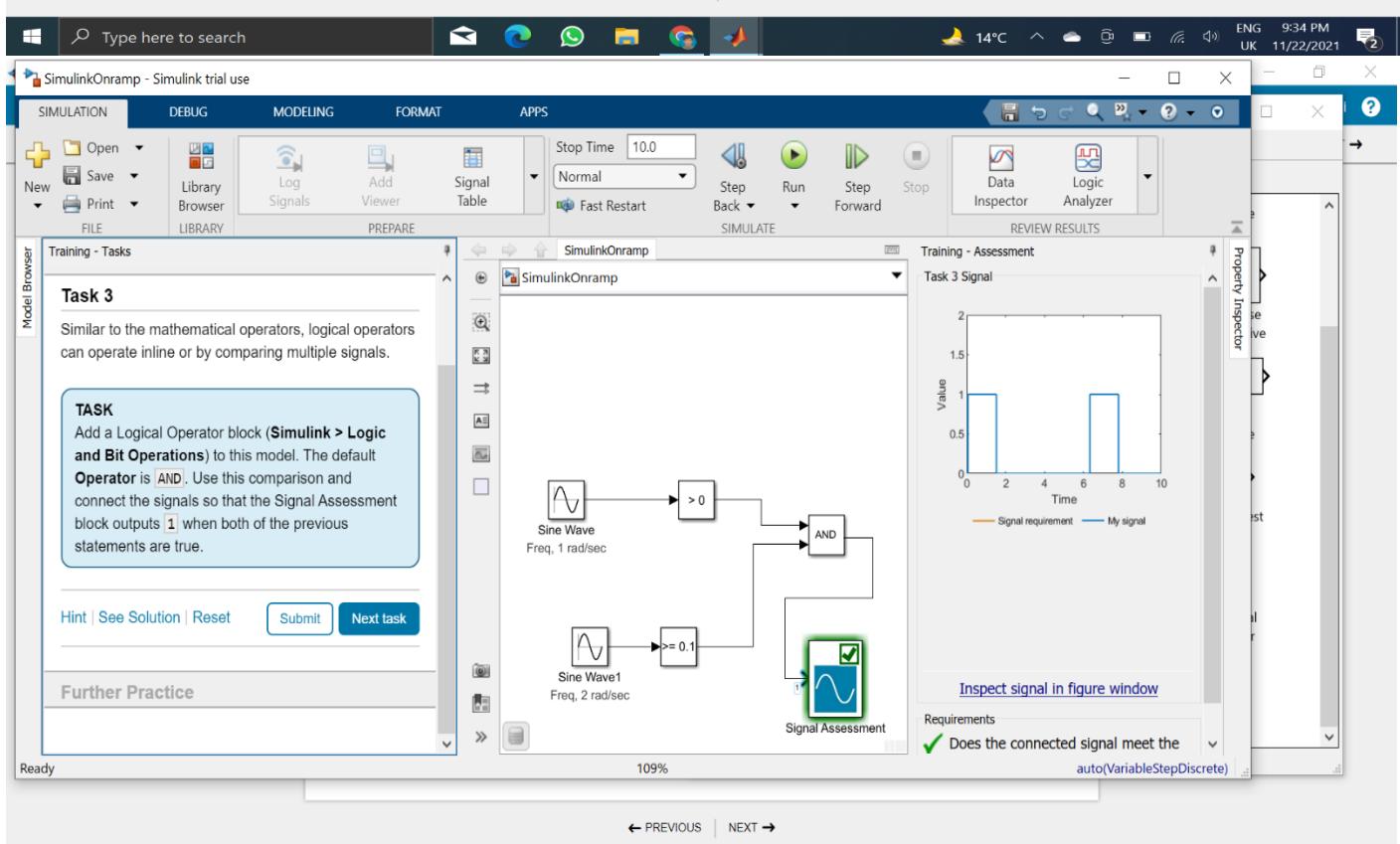
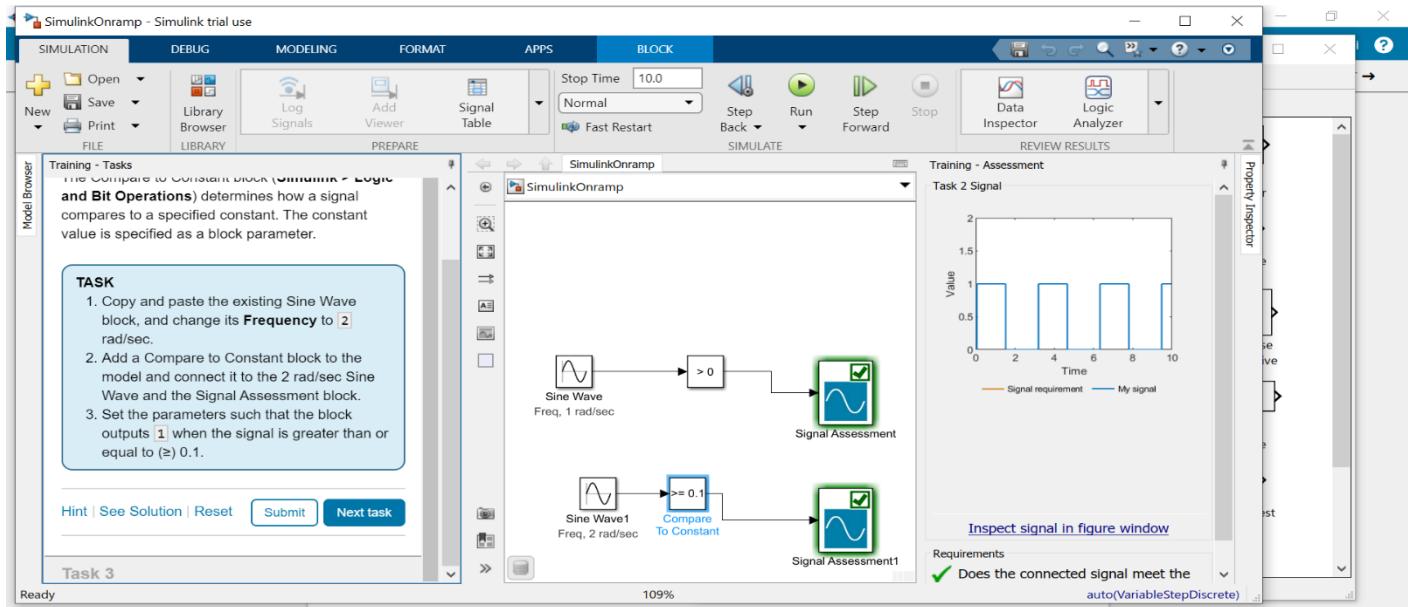
Requirements

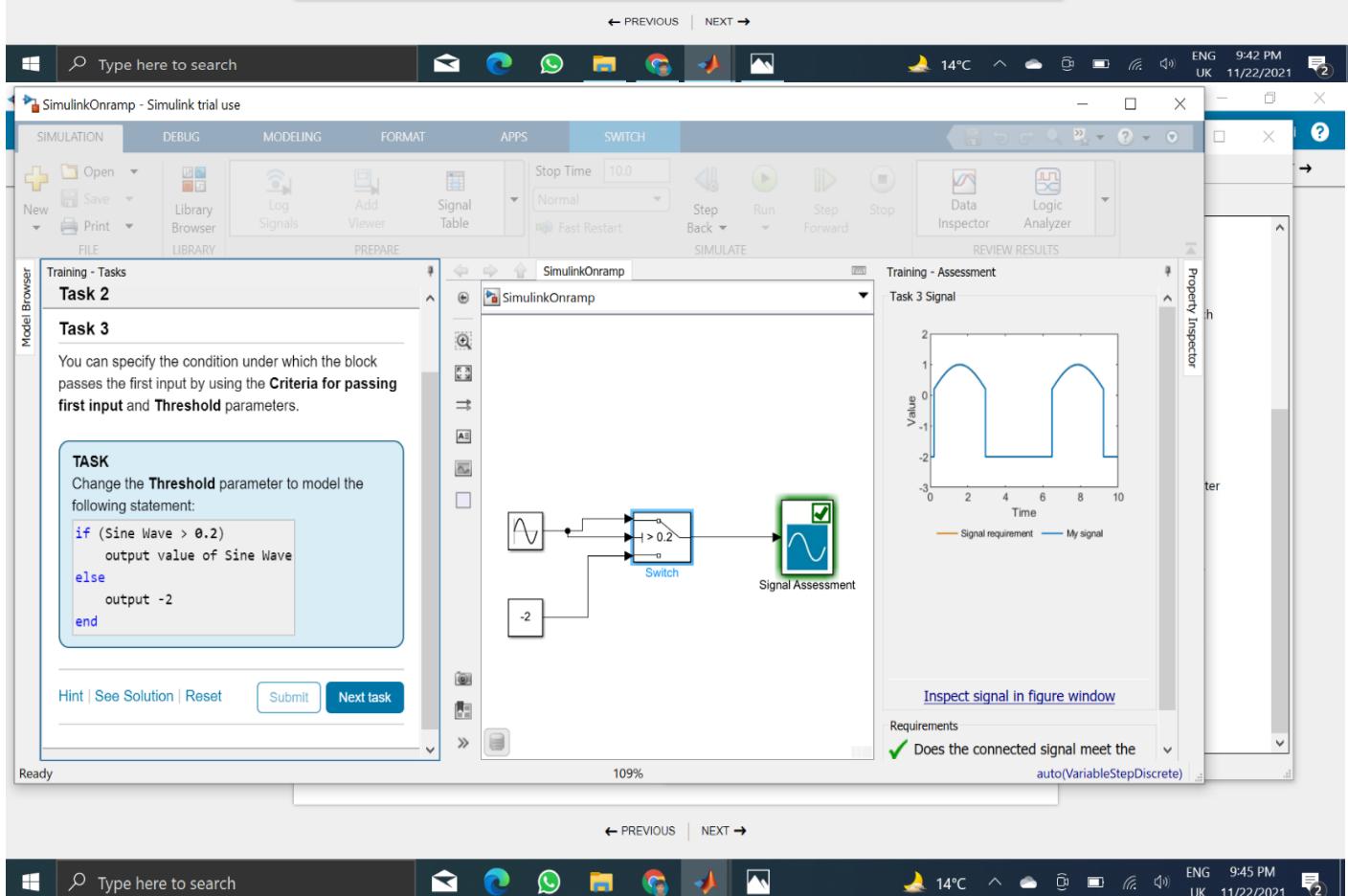
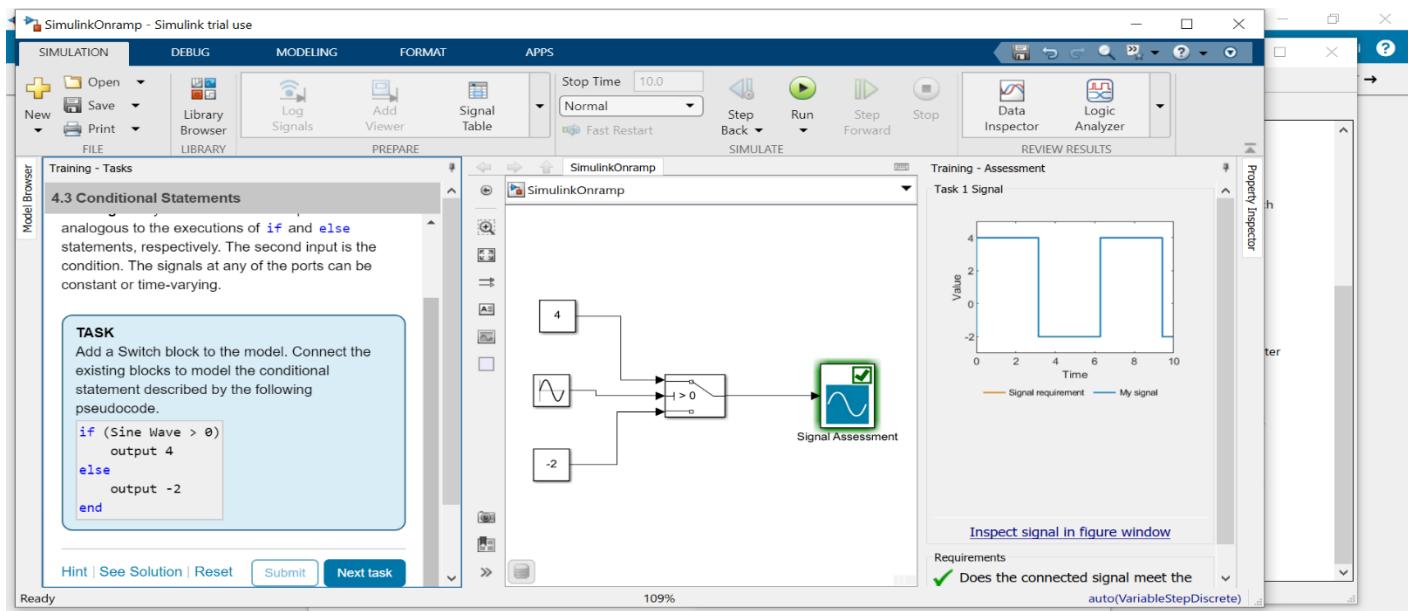
✓ Does the connected signal meet the **auto(VariableStepDiscrete)**



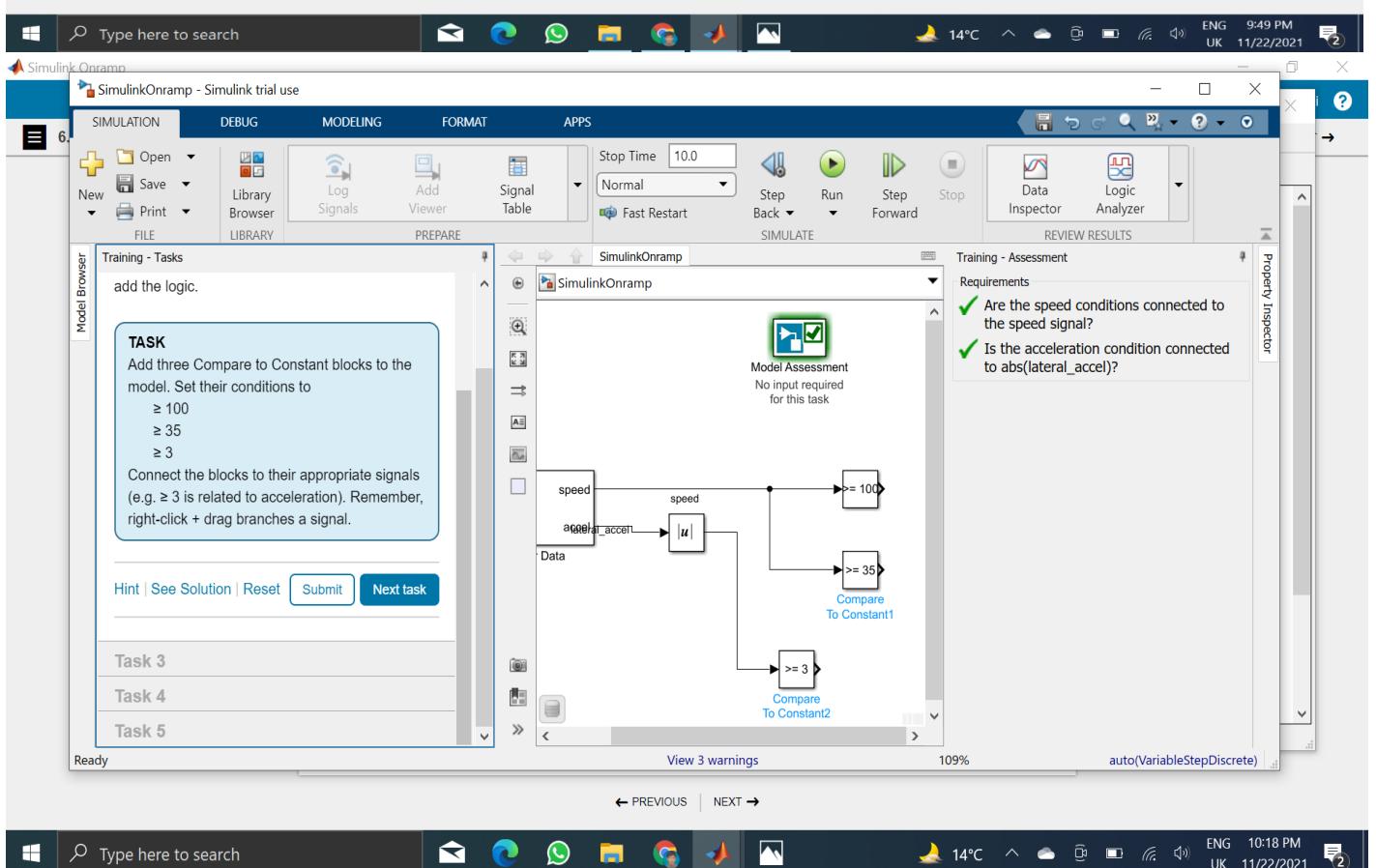
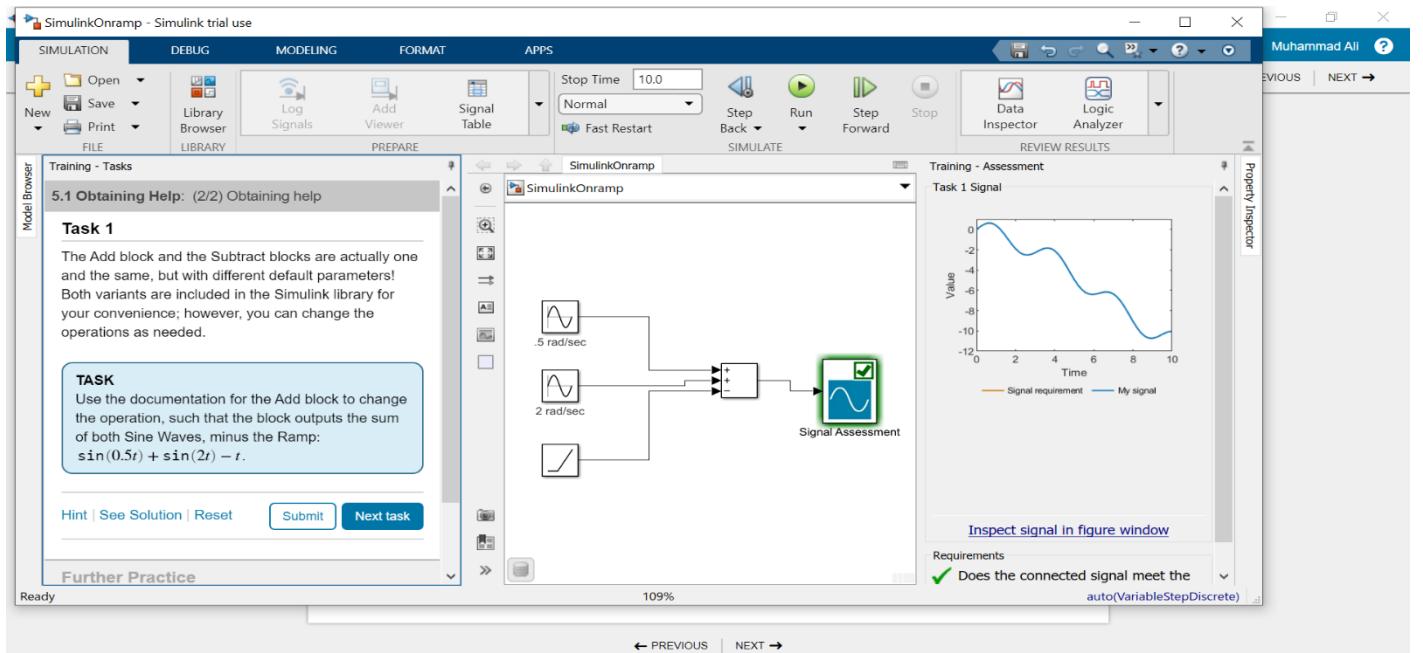
Logical operation with input sinusoid: -



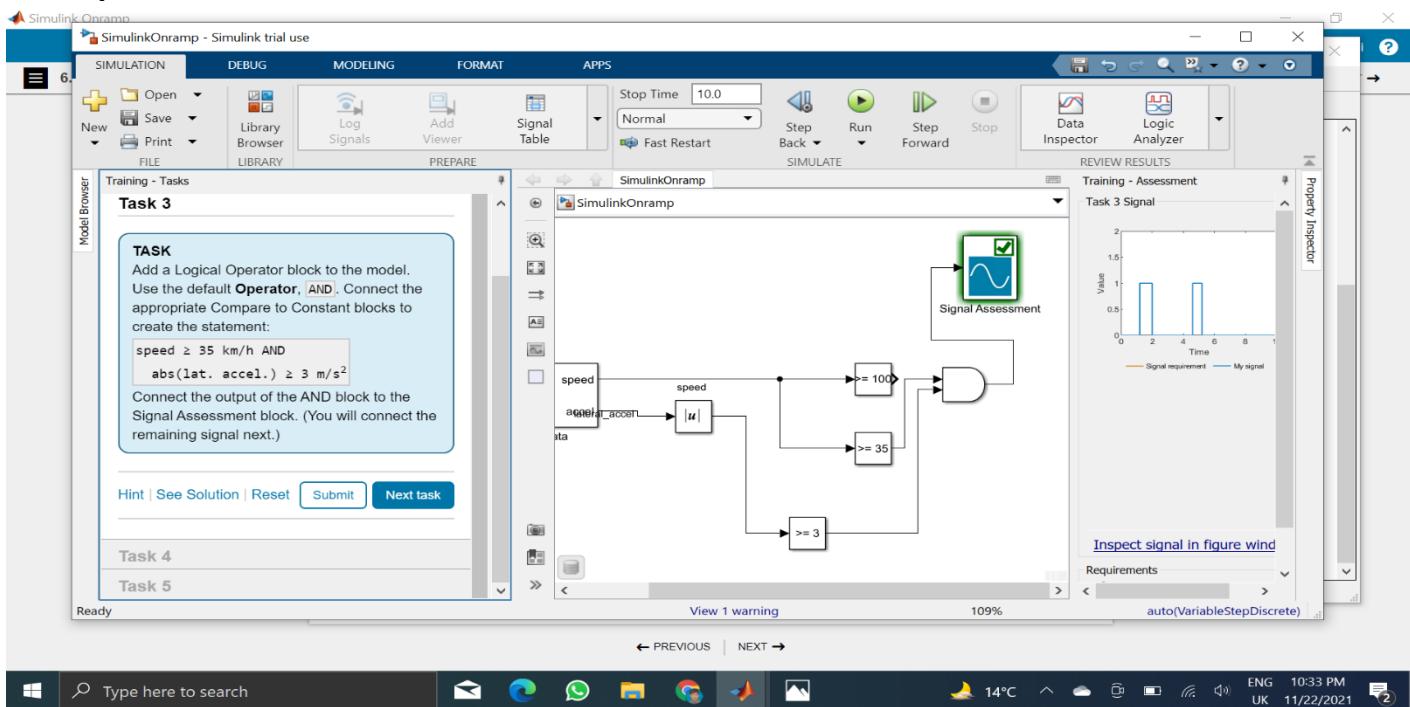




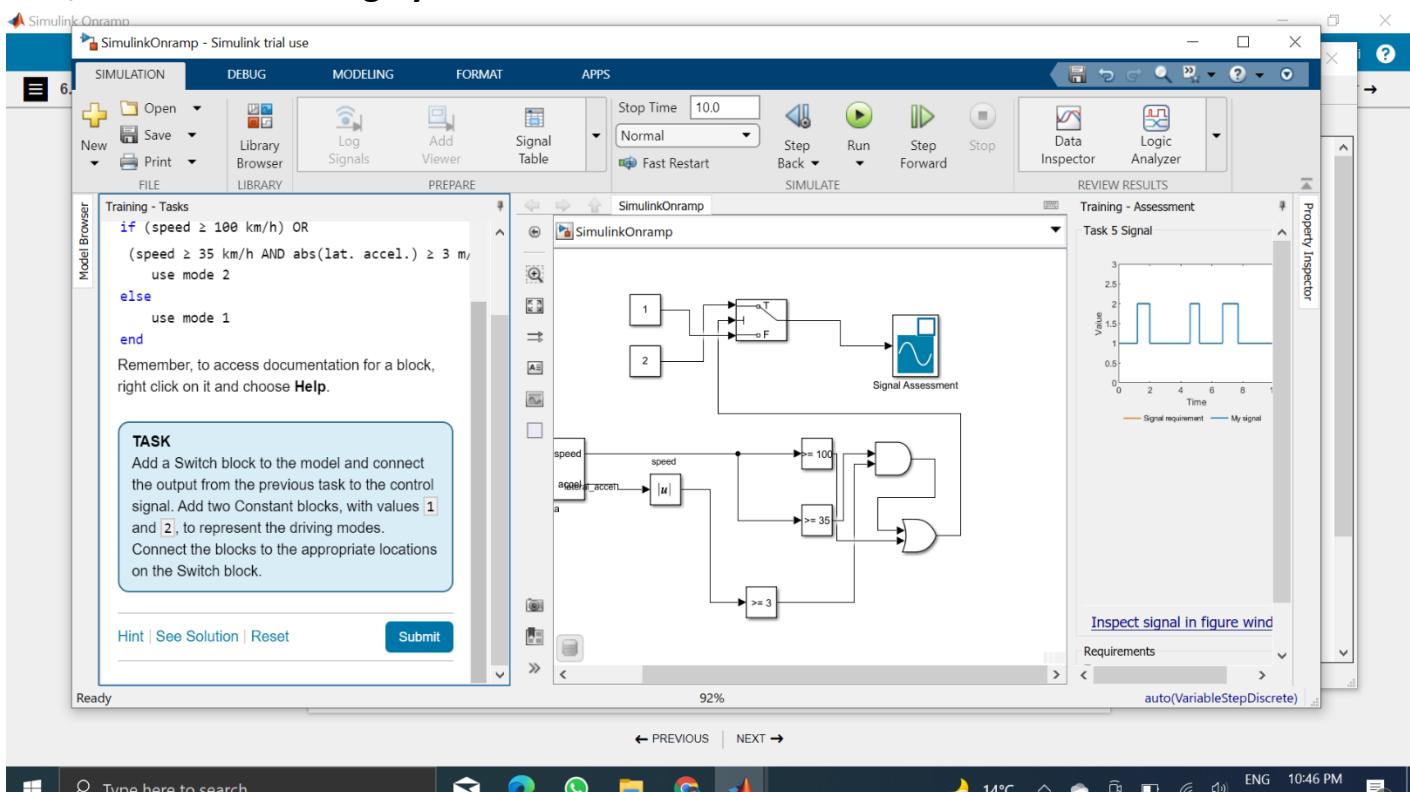
Arithmetic operation and conditional blocks: -



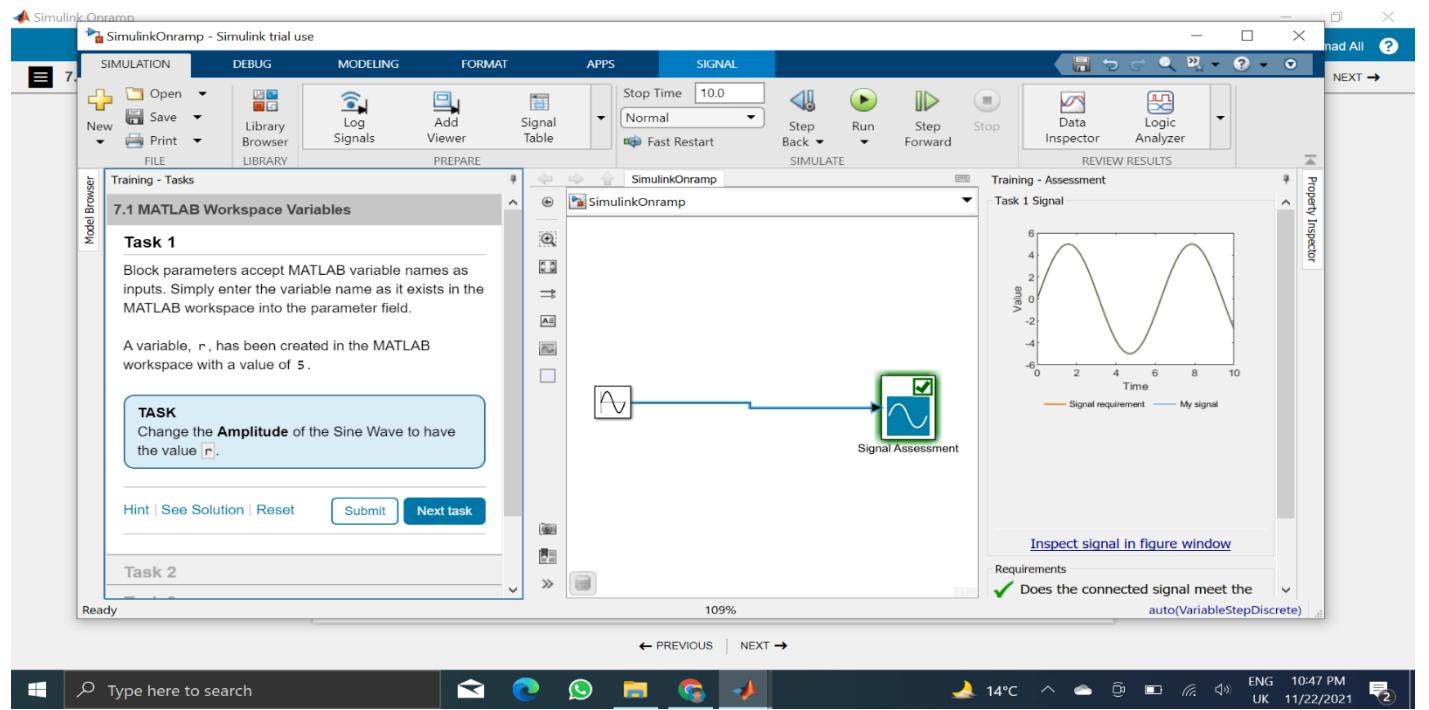
And operation: -



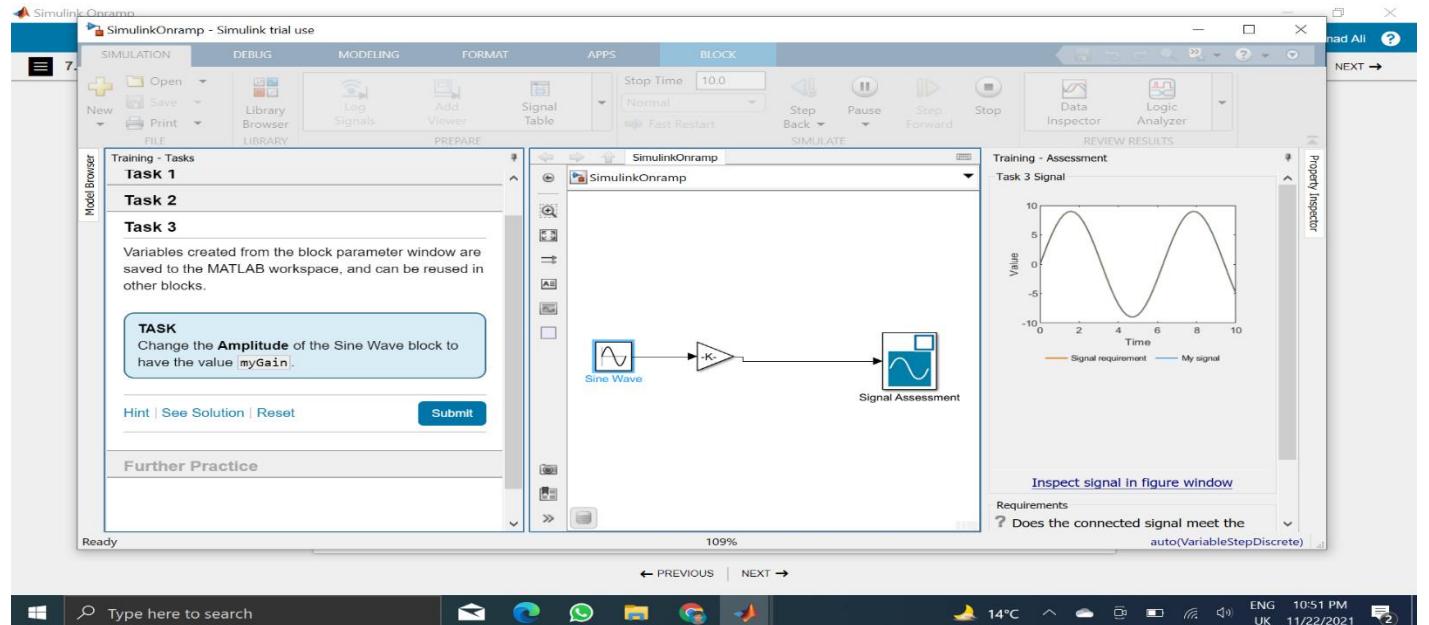
And, or and then scaling by switch block: -



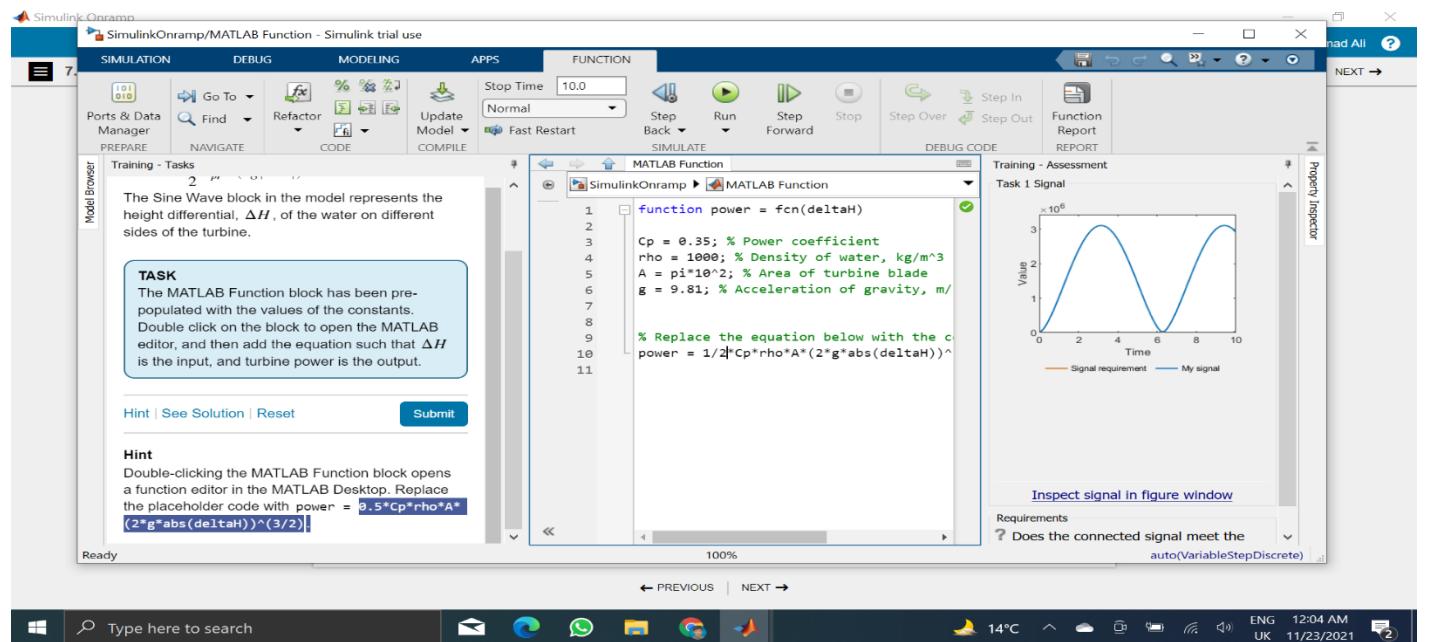
Using variable(r): -



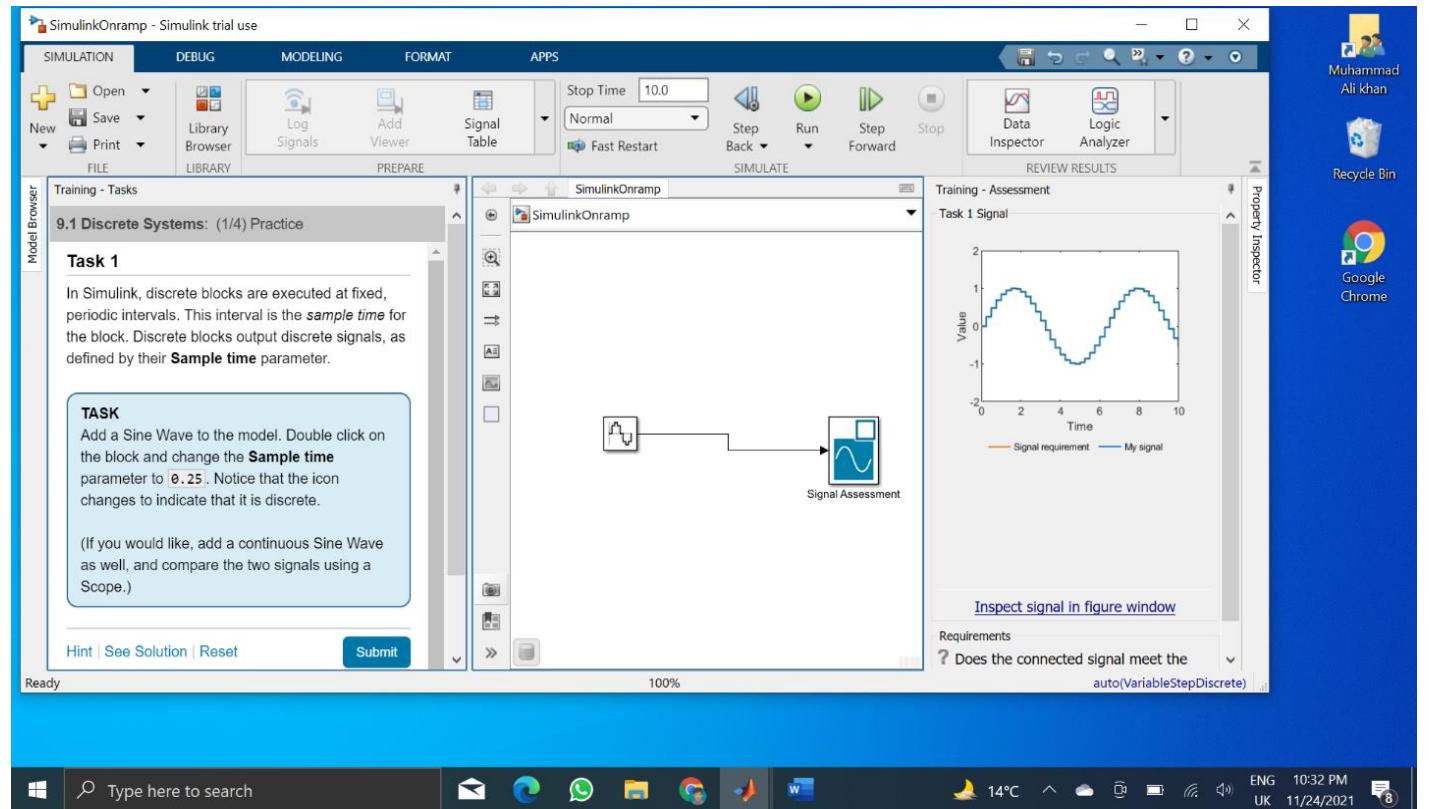
Using our own variable(r): -



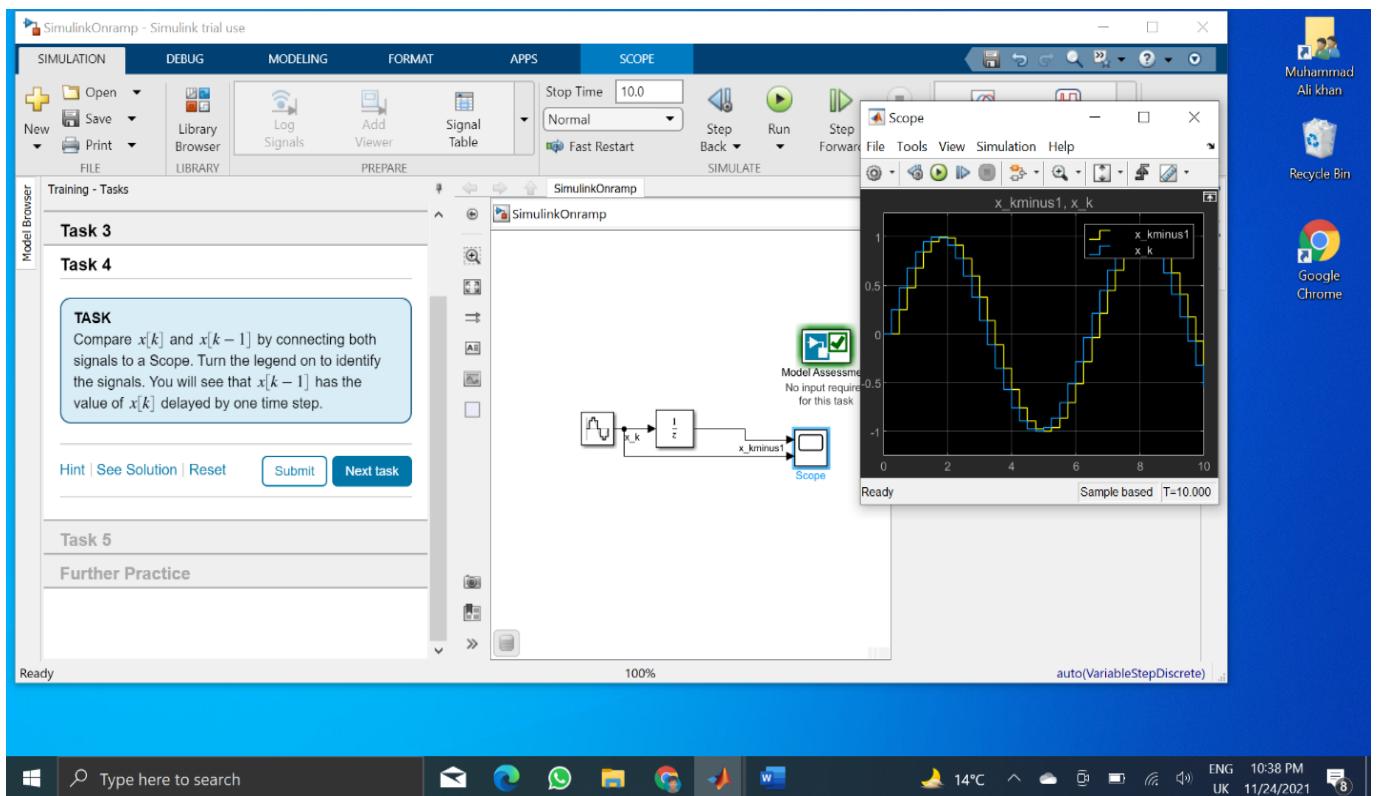
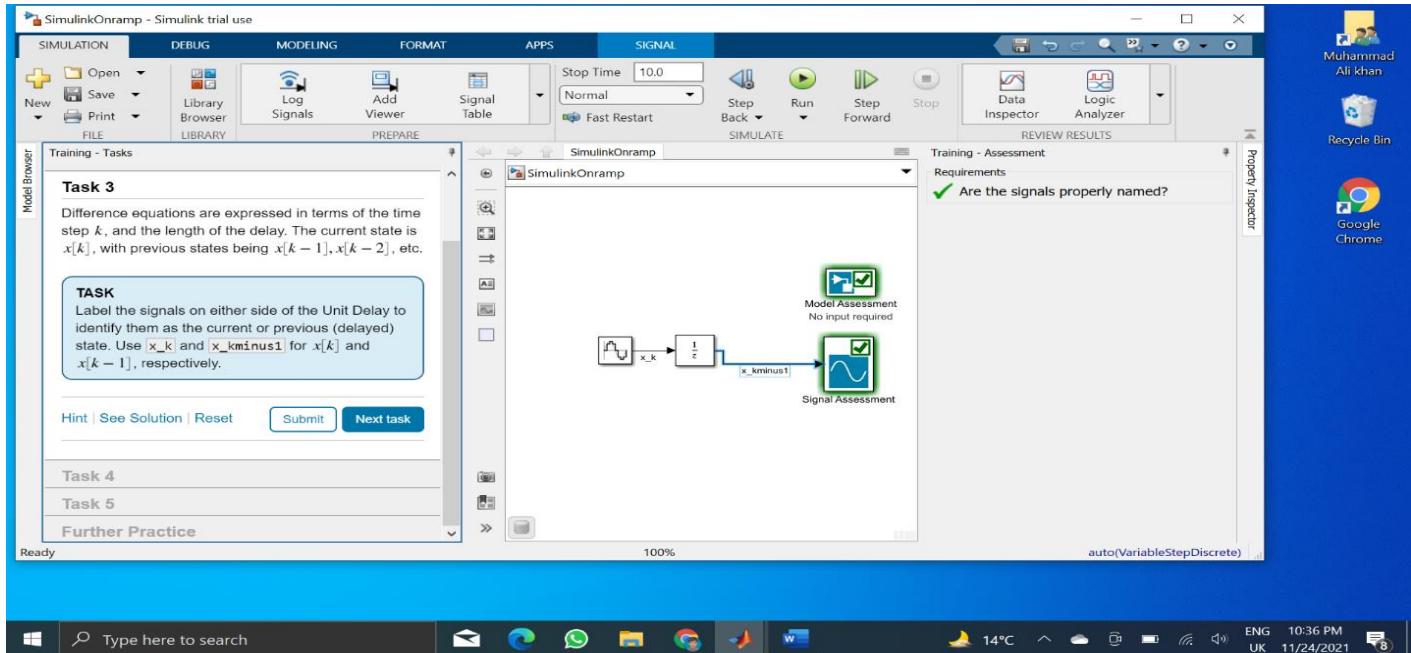
MATLAB function: -



Discrete system: -



Unit Delay discrete signal: -



SimulinkOnramp - Simulink trial use

SIMULATION DEBUG MODELING FORMAT APPS SCOPE

FILE Open Save Print Library Browser PREPARE

Stop Time: 10.0 Normal Step Back Run Step Forward SIMULATE

Training - Tasks

Task 3

Task 4

Task 5

The Unit Delay block has its own **Sample time** parameter. By default, this is set to **-1**, meaning that it inherits the sample time from elsewhere in the model—in this case, from the Sine Wave. However, you can also specify an independent rate for the Unit Delay; for example, if you need to downsample your signal.

TASK
Double-click on the Unit Delay block and set the **Sample time** to **0.5**. Run the model and use the Scope to compare the two signals.

Hint | See Solution | Reset Submit Next task

Scope

SimulinkOnramp

Model Assessment: No input required for this task

Scope

x_kminus1, x_k

Ready Sample based T=10.000

auto(VariableStepDiscrete)

Ready 100%

14°C ENG UK 10:40 PM 11/24/2021

SimulinkOnramp - Simulink trial use

SIMULATION DEBUG MODELING FORMAT APPS BLOCK

FILE Open Save Print Library Browser PREPARE

Stop Time: 10.0 Normal Step Back Run Step Forward Stop REVIEW RESULTS

Training - Tasks

position based on its last known position, velocity, and time between observations:
 $x[k] = x[k - 1] + v \cdot T_s$

The time between observations, T_s , is the sample time of this discrete system. Assume $T_s = 0.25$.

Good practice for modeling discrete, dynamic systems is to begin with the Unit Delay blocks.

TASK
The equation above contains one delay:
 $x[k] \Rightarrow x[k - 1]$.
Add one Unit Delay block to the model and set the **Sample time** to **0.25**.

Hint | See Solution | Reset Submit Next task

Task 2

Unit Delay

Model Assessment: No input required for this task

Training - Assessment

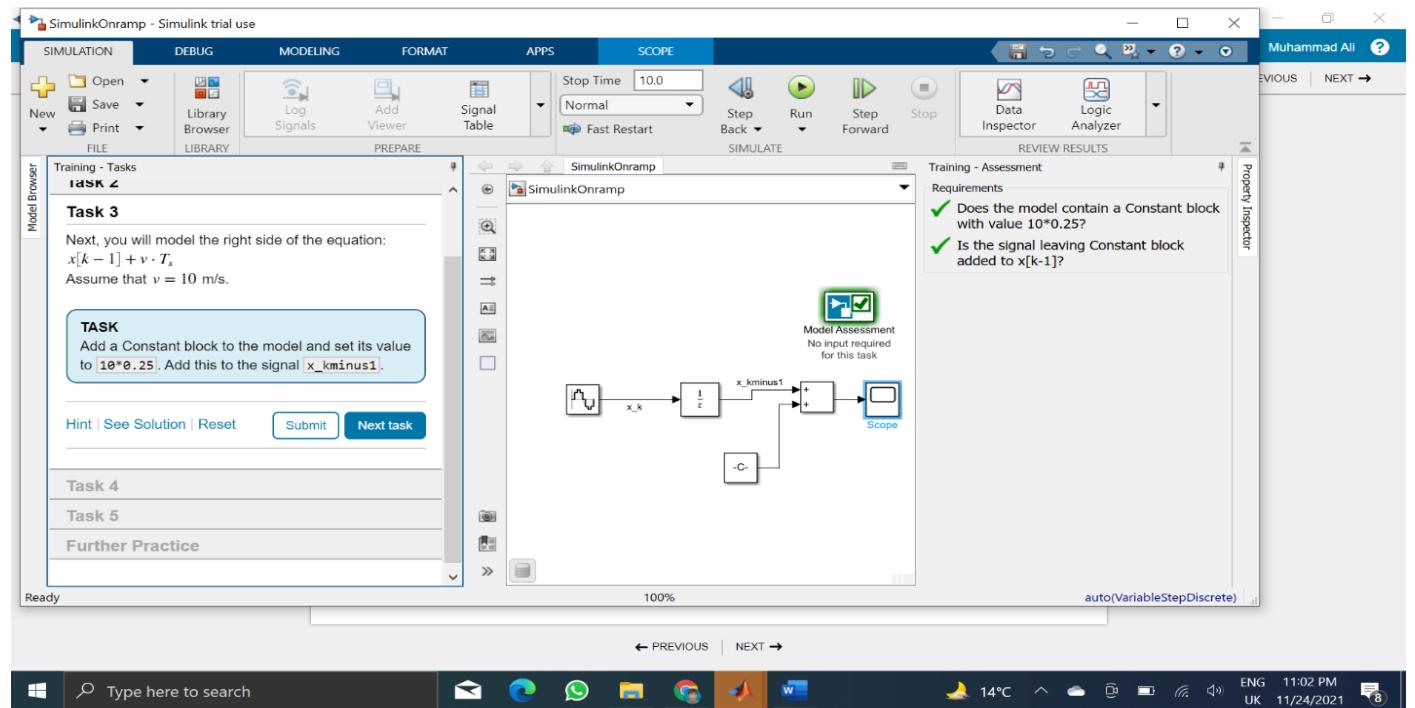
Requirements

- ✓ Does the model contain a Unit Delay block?
- ✓ Is the Sample time set to 0.25 on the Unit Delay block?

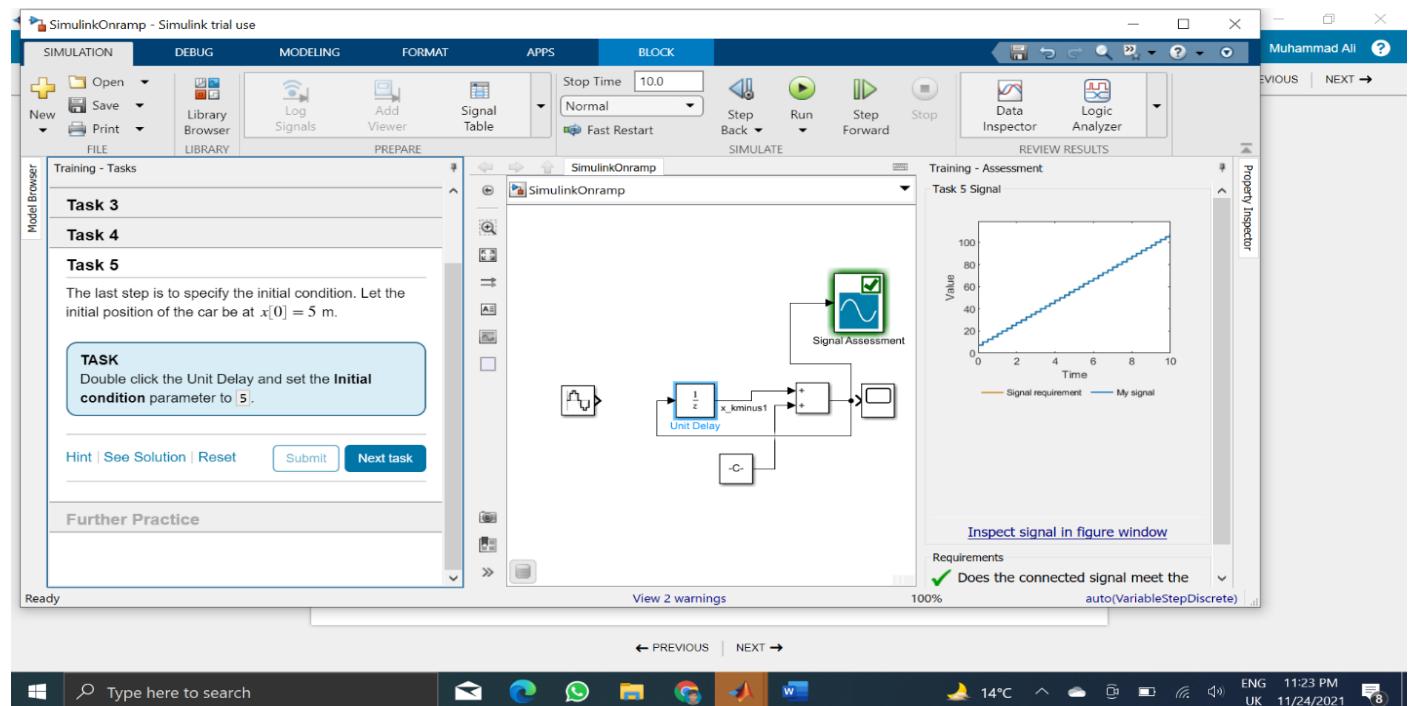
PREVIOUS NEXT →

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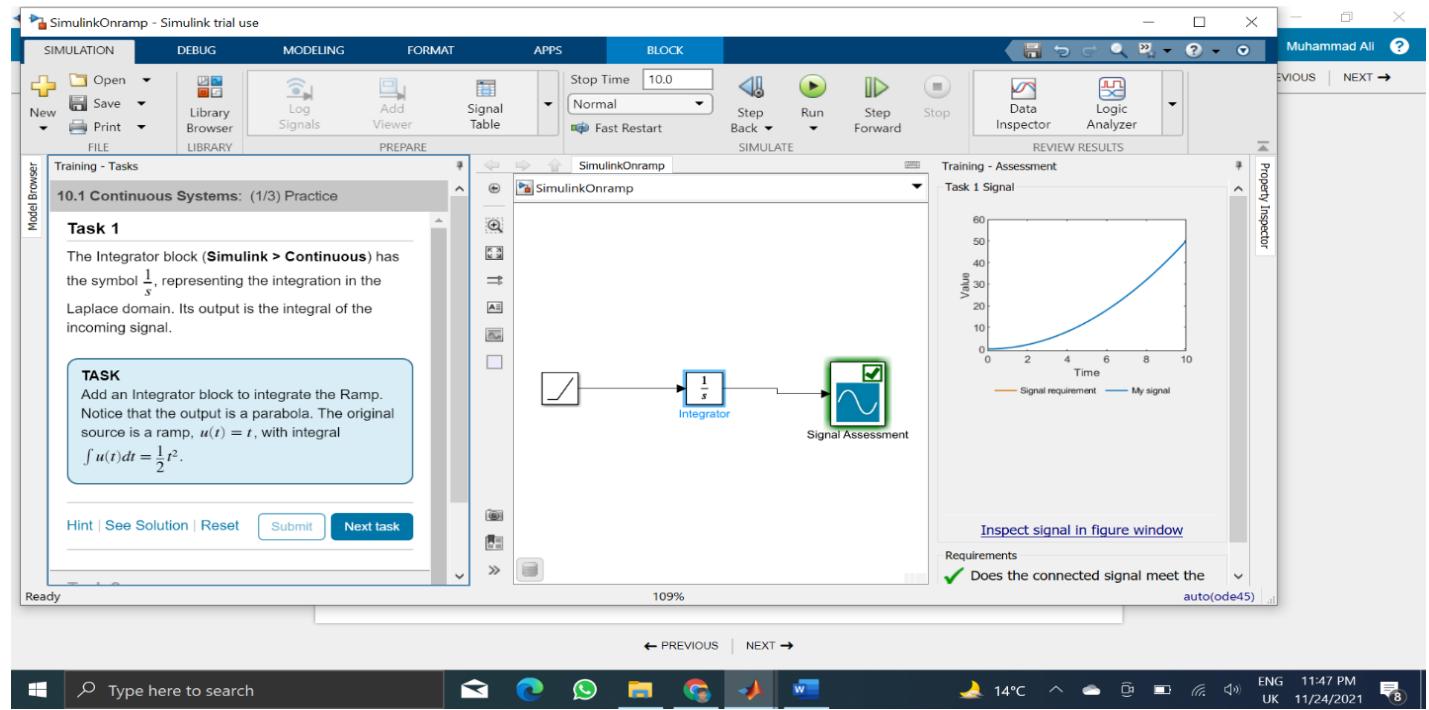
Add constant to existing signal: -



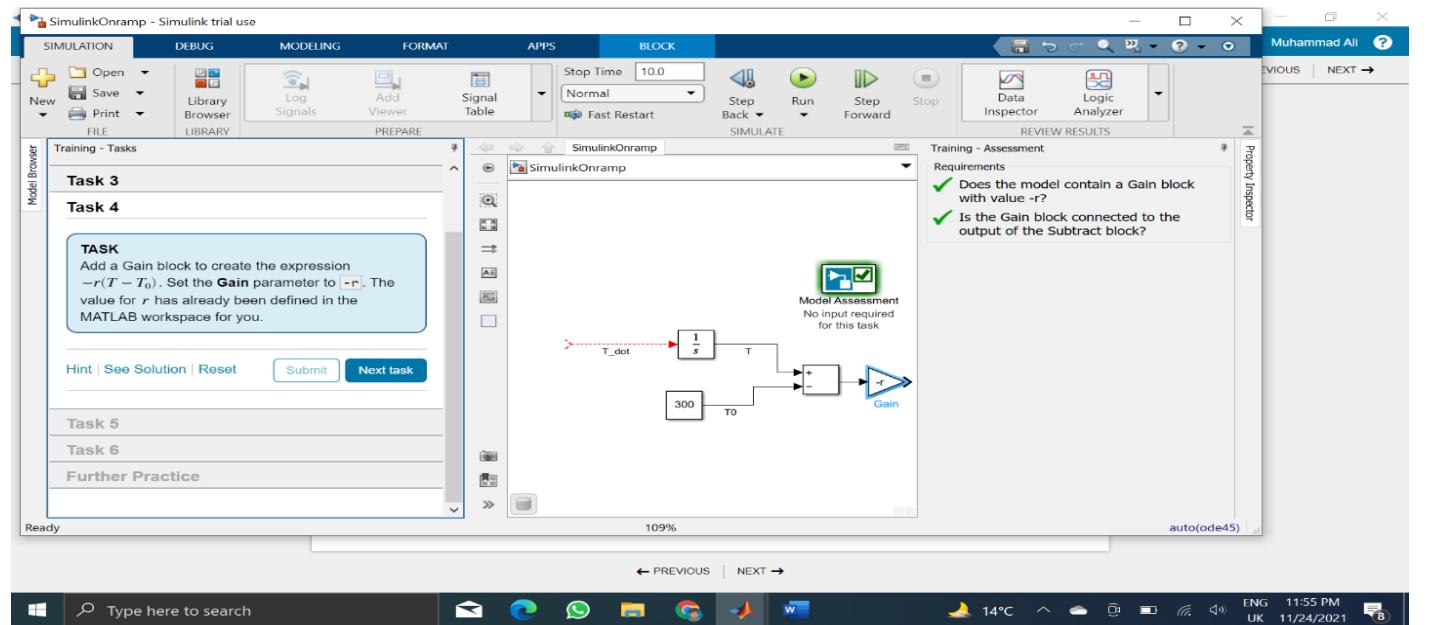
Equating equations and setting unit delay initial value to 5:-



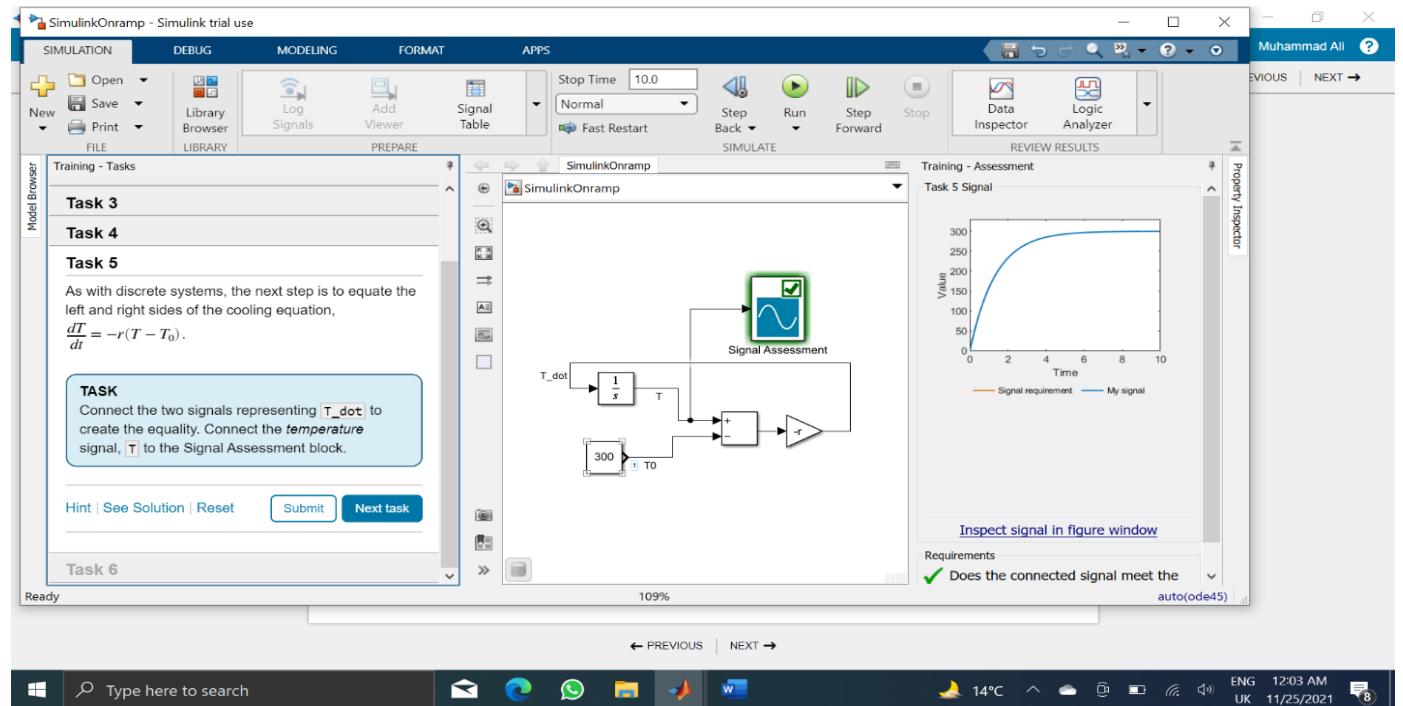
Integrator function: -

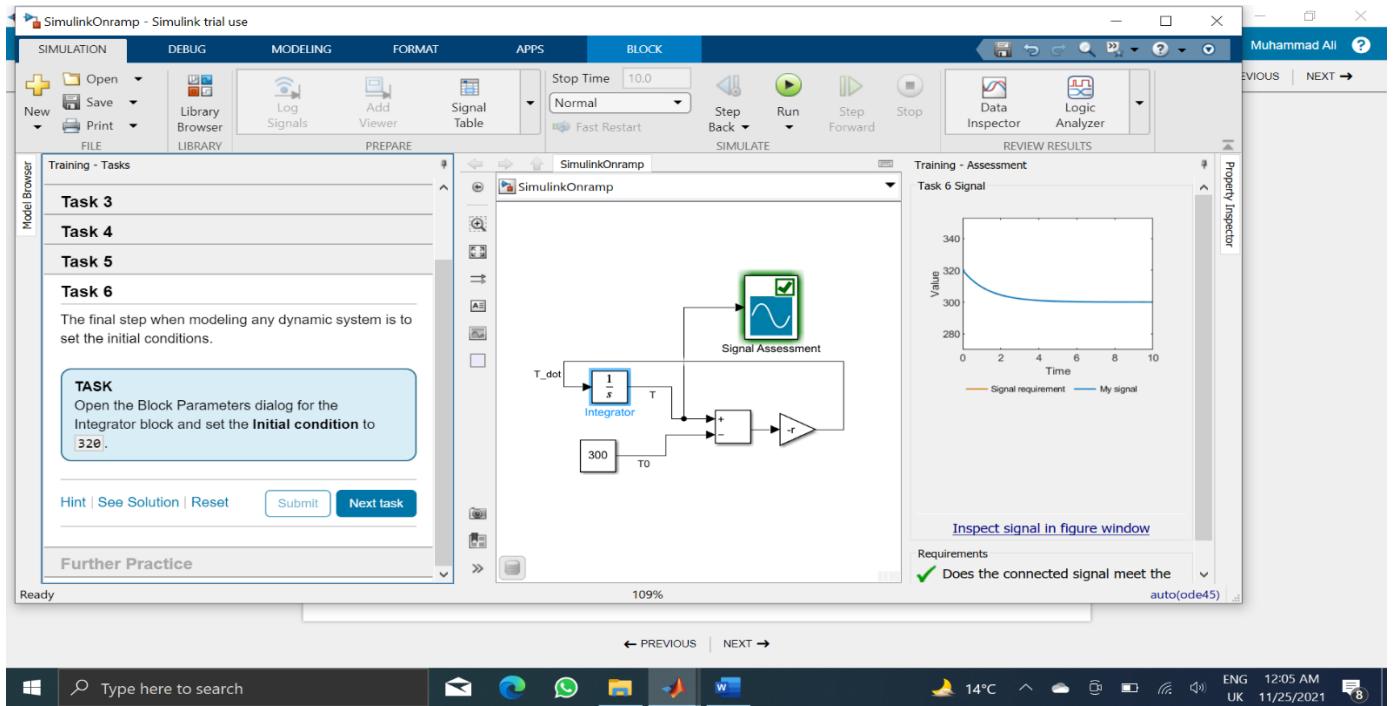


Subtracting constant 300 from integrated signal and then multiply with gain -r: -

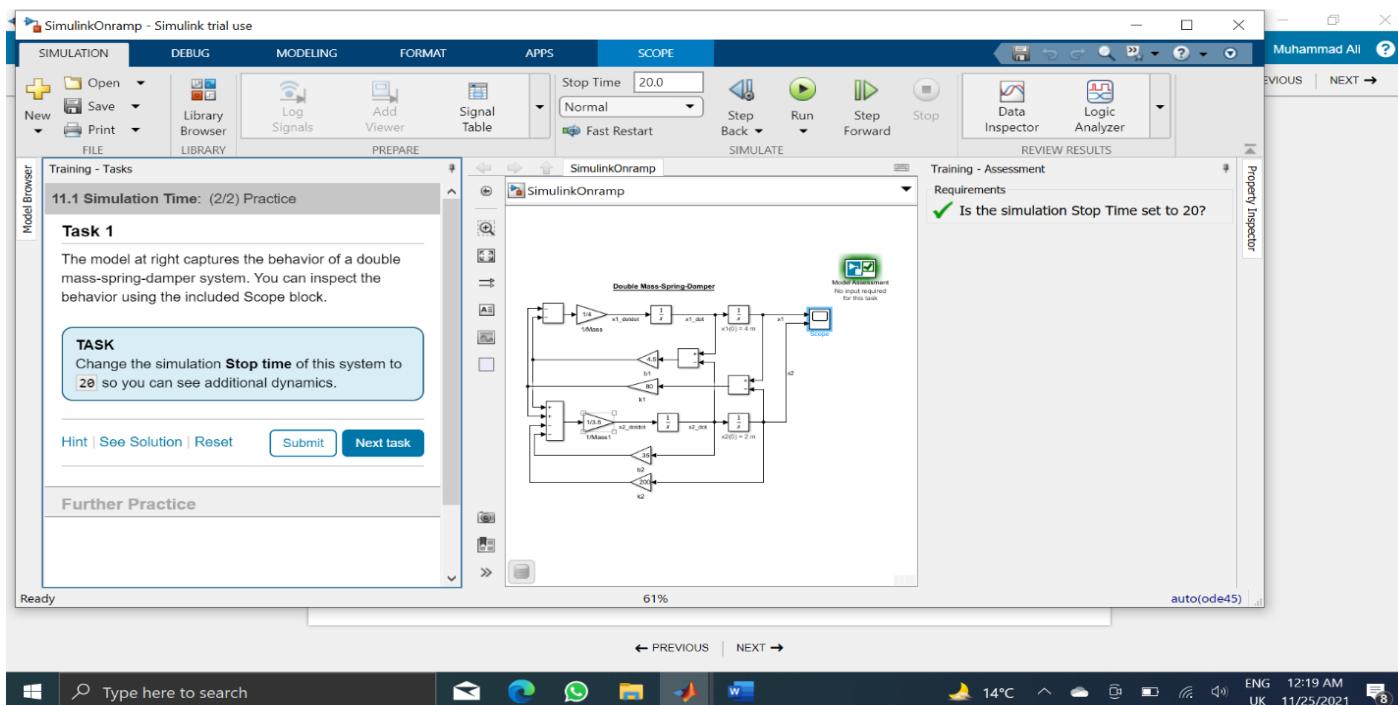


Equality: -

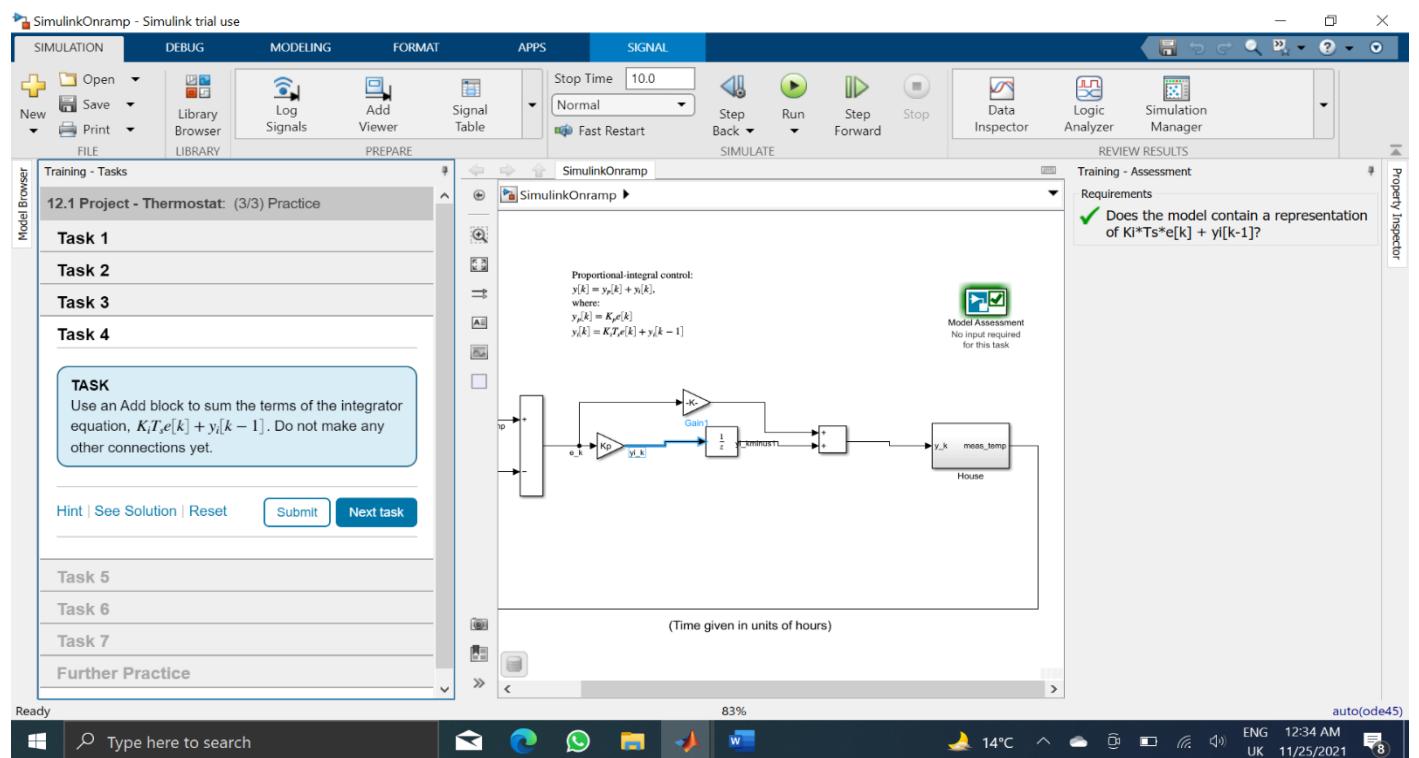
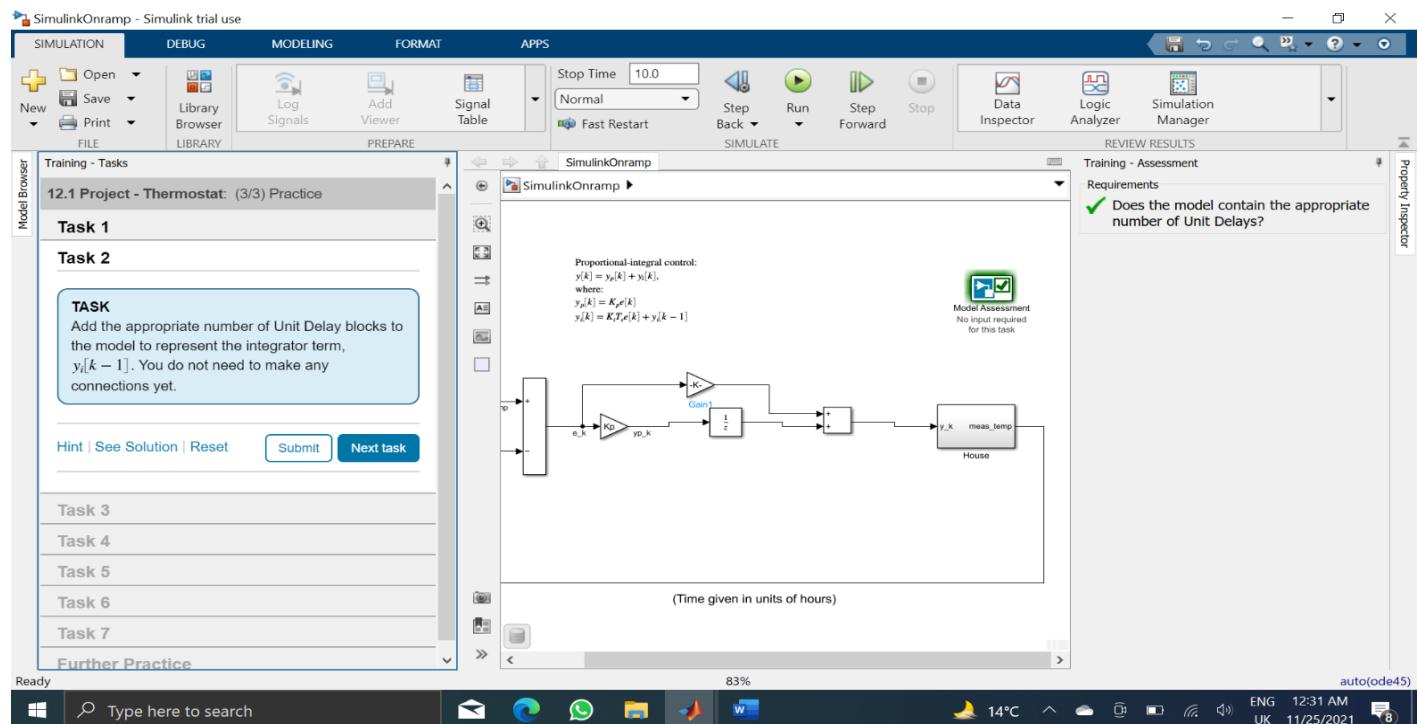


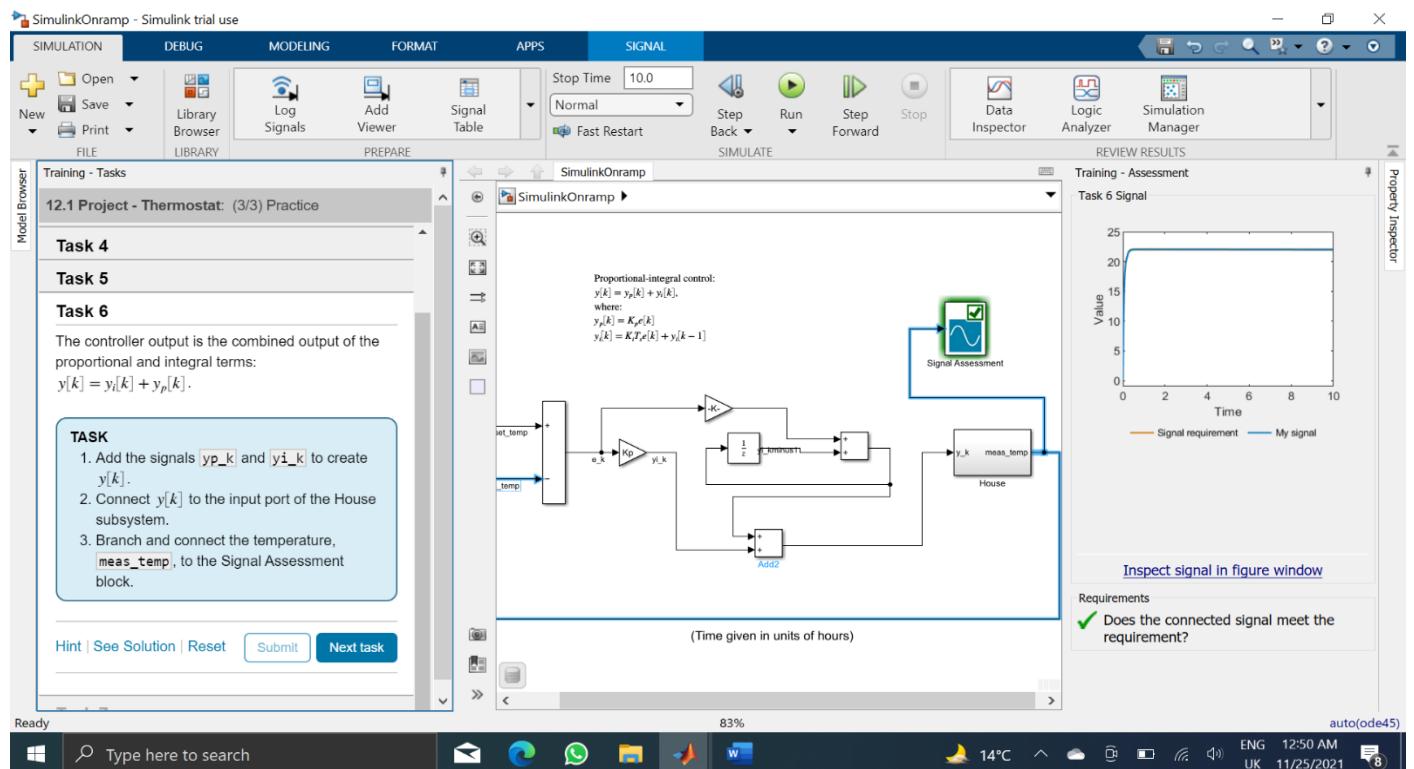


Stop time: -

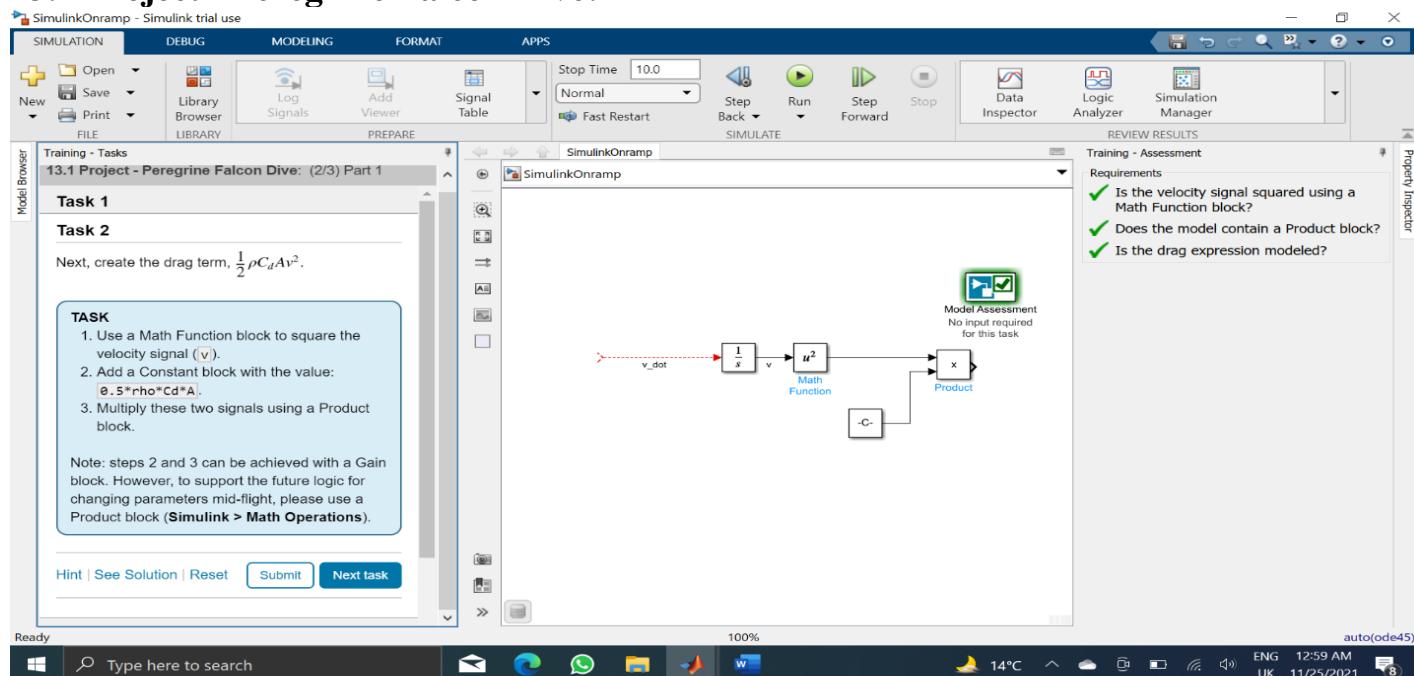


Thermostat project: -





13.1 Project - Peregrine Falcon Dive: -



Equating: -

SimulinkOnramp - Simulink trial use

SIMULATION DEBUG MODELING FORMAT APPS BLOCK

FILE New Print LIBRARY PREPARE

Training - Tasks
13.1 Project - Peregrine Falcon Dive: (2/3) Part 1

Task 1

Task 2

Task 3

Task 4

Task 5

Task 6
The final step in modeling dynamic systems is always to set the initial conditions.

TASK
Set the Initial condition for velocity to **-10** (m/s).

Hint | See Solution | Reset Submit Next task

Further Practice

Model Browser

SimulinkOnramp

Signal Assessment

REVIEW RESULTS

Training - Assessment
Task 6 Signal

Value

Time

Signal requirement My signal

Inspect signal in figure window

Requirements

✓ Does the connected signal meet the requirement?

Ready

Type here to search

14°C ENG UK 11/25/2021 1:05 AM

13.1 Project - Peregrine Falcon Dive (part 3): -

SimulinkOnramp - Simulink trial use

SIMULATION DEBUG MODELING FORMAT APPS

FILE New Print LIBRARY PREPARE

Training - Tasks
13.1 Project - Peregrine Falcon Dive: (2/3) Part 1

Task 1

Task 2

Next, create the drag term, $\frac{1}{2} \rho C_d A v^2$.

TASK

1. Use a Math Function block to square the velocity signal (v).
2. Add a Constant block with the value: $0.5 \cdot \rho \cdot C_d \cdot A$.
3. Multiply these two signals using a Product block.

Note: steps 2 and 3 can be achieved with a Gain block. However, to support the future logic for changing parameters mid-flight, please use a Product block (Simulink > Math Operations).

Hint | See Solution | Reset Submit Next task

Model Browser

SimulinkOnramp

Model Assessment
No input required for this task

REVIEW RESULTS

Training - Assessment

Requirements

- ✓ Is the velocity signal squared using a Math Function block?
- ✓ Does the model contain a Product block?
- ✓ Is the drag expression modeled?

Ready

Type here to search

14°C ENG UK 11/25/2021 12:59 AM

SimulinkOnramp - Simulink trial use

SIMULATION DEBUG MODELING FORMAT APPS

FILE PREPARE

Training - Tasks

13.1 Project - Peregrine Falcon Dive: (3/3) Part 2

```

else
Cd = Cd2, A = A2
end

```

TASK
Copy and paste the Constant block named `Low_Drag`. Rename it to `High_Drag` and change its value to `0.5*rho*Cd2*A2`. Connect the constants to the appropriate data inputs, remembering that the first port evaluates if the condition specified is true.

Hint | See Solution | Reset | Submit | Next task

Task 3
Task 4
Task 5
Task 6
Task 7

Model Browser

SimulinkOnramp

REVIEW RESULTS

Training - Assessment Requirements

- ✓ Does the model contain two Constant blocks representing the drag term coefficients?
- ✓ Are the Constant blocks appropriately connected to the Switch block?

Model Assessment: No input required for this task

Ready

Type here to search

14°C 11:19 AM ENG UK 11/25/2021

SimulinkOnramp - Simulink trial use

SIMULATION DEBUG MODELING FORMAT BLOCK APPS

FILE PREPARE

Training - Tasks

13.1 Project - Peregrine Falcon Dive: (3/3) Part 2

Task 1
Task 2
Task 3
Task 4
Task 5
Since you added a new Integrator block, you need to set its initial condition as well.

TASK
Set the Initial condition to `60` (m).

Hint | See Solution | Reset | Submit | Next task

Task 6
Task 7
Further Practice

Model Browser

SimulinkOnramp

REVIEW RESULTS

Training - Assessment Task 5 Signal

Value

Time

Signal requirement: 0
My signal: 60

Inspect signal in figure window

Requirements

- ✓ Does the connected signal meet the requirement?

Signal Assessment

View 1 warning

100% auto(ode45)

Ready

Type here to search

14°C 11:19 AM ENG UK 11/25/2021

