# SOLUTION OF ONE DIMENSIONAL HEAT EQUATION

1. $u_t - u_{xx} = 0,\ 0 < x < 5,\ t > 0$

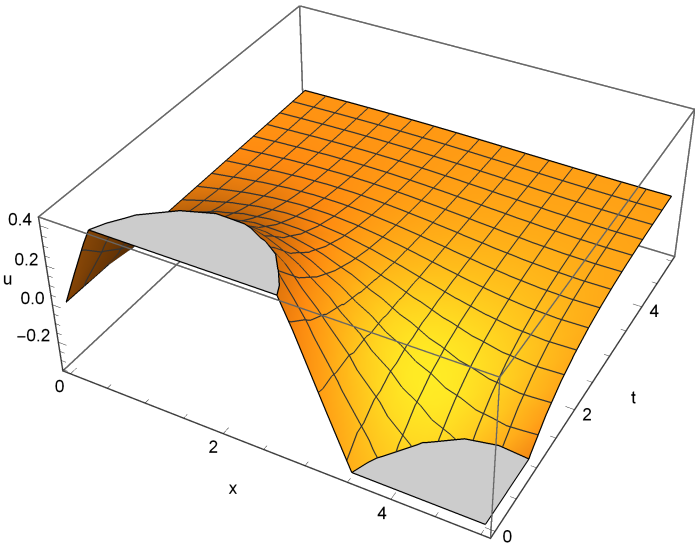
$u(x, 0) = \text{Sin}[x],\ 0 \le x \le 5$

$u(0, t) = 0,\ t \ge 0$

$u(5, t) = 0,\ t \ge 0.$

In[ ]:=
```
eqn1 = {∂t u[x, t] - ∂x,x u[x, t] == 0, u[x, 0] == Sin[x], u[0, t] == 0, u[5, t] == 0};
sol1 = NDSolve[eqn1, u[x, t], {x, 0, 5}, {t, 0, 10}, PrecisionGoal → 3] // Quiet;
Plot3D[u[x, t] /. sol1, {x, 0, 5}, {t, 0, 5}, AxesLabel → {"x", "t", "u"}]
```

Out[ ]=




2. $u_t - u_{xx} = 0,\ 0 < x < 20,\ t > 0$

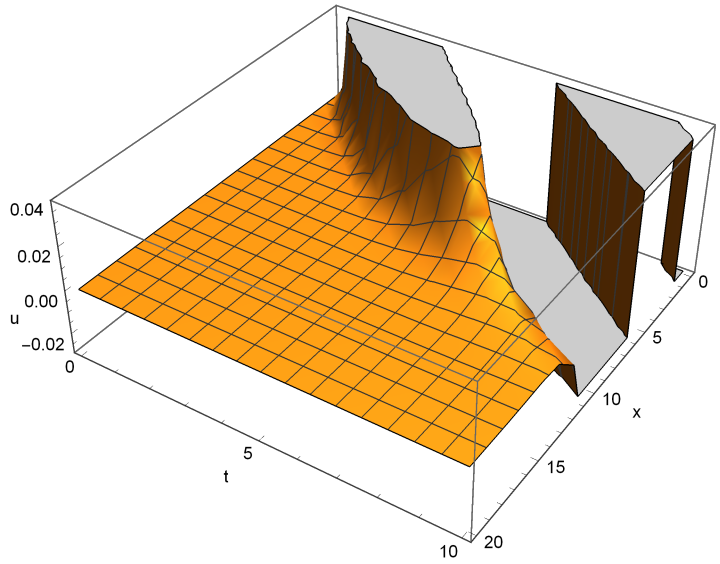
$u(x, 0) = 0,\ 0 \le x \le 20$

$u(0, t) = t^2 * \text{Sin}[t],\ t \ge 0$

$u(20, t) = 0,\ t \ge 0.$

In[•]:=
```
eqn1 = {∂t u[x, t] - ∂x,x u[x, t] == 0, u[x, 0] == 0, u[0, t] == t^2 * Sin[t], u[20, t] == 0};
sol1 = NDSolve[eqn1, u[x, t], {x, 0, 20}, {t, 0, 10}, PrecisionGoal → 3] // Quiet;
Plot3D[u[x, t] /. sol1, {x, 0, 20}, {t, 0, 10}, AxesLabel → {"x", "t", "u"}]
```

Out[•]=




3. $u_t - u_{xx} = 0,\ 0 < x < 20,\ t > 0$

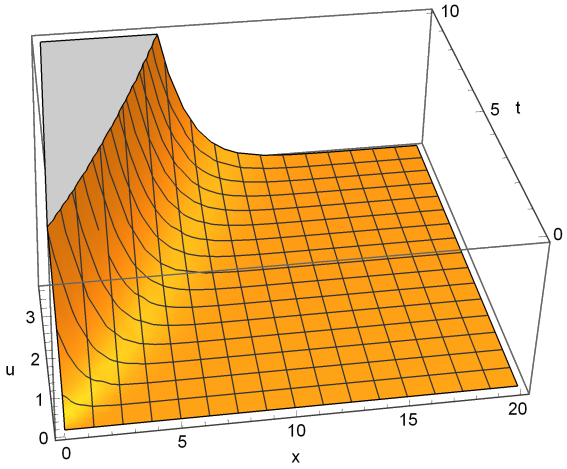
$u(x, 0) = 0,\ 0 \le x \le 20$

$u(0, t) = t^2,\ t \ge 0$

$u(20, t) = 0,\ t \ge 0.$

In[•]:=
```
eqn1 = {∂t u[x, t] - ∂x,x u[x, t] == 0, u[x, 0] == 0, u[0, t] == t^2, u[20, t] == 0};
sol1 = NDSolve[eqn1, u[x, t], {x, 0, 20}, {t, 0, 10}, PrecisionGoal → 3] // Quiet;
Plot3D[u[x, t] /. sol1, {x, 0, 20}, {t, 0, 10}, AxesLabel → {"x", "t", "u"}]
```

Out[•]=




4. $u_t - u_{xx} = 0,\ 0 < x < 5,\ t > 0$

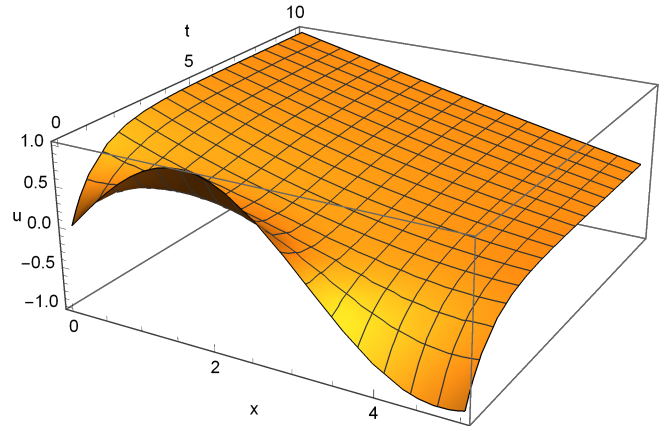
$u(x, 0) = \sin[x],\ 0 \le x \le 5$

$u(0, t) = 1,\ t \ge 0$

$u(5, t) = 0, \quad t \geq 0.$

In[•]:=
```
eqn1 = {∂t u[x, t] - ∂x,x u[x, t] == 0, u[x, 0] == Sin[x], u[0, t] == 1, u[5, t] == 0};
sol1 = NDSolve[eqn1, u[x, t], {x, 0, 5}, {t, 0, 10}, PrecisionGoal → 3] // Quiet;
Plot3D[u[x, t] /. sol1, {x, 0, 5}, {t, 0, 10}, AxesLabel → {"x", "t", "u"}]
```

Out[•]=




5. $u_t - u_{xx} = 0, \quad 0 < x < 10, \quad t > 0$

$u(x, 0) = \text{Tanh}[x], \quad 0 \leq x \leq 10$

$u(0, t) = t, \quad t \geq 0$

$u(10, t) = 0, \quad t \geq 0.$

In[1]:=
```
eqn1 = {∂t u[x, t] - ∂x,x u[x, t] == 0, u[x, 0] == Tanh[x], u[0, t] == t, u[10, t] == 0};
sol1 = NDSolve[eqn1, u[x, t], {x, 0, 10}, {t, 0, 10}, PrecisionGoal → 3] // Quiet;
Plot3D[u[x, t] /. sol1, {x, 0, 10}, {t, 0, 10}, AxesLabel → {"x", "t", "u"}]
```

Out[3]=