Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 1

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<1,\ 0<t \\ \frac{\partial u}{\partial x}(0,t)=\frac{\partial u}{\partial x}(1,t)=0 & 0\le t \\ u(x,0)=3\,(x-1)\left(x-\frac{1}{2}\right)\left(x-\frac{1}{10}\right)x & 0\le x\le 1 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point $x=\frac{1}{5}$

and the moment $t=0.005$ by means of a Fourier series of order 8 .

1) $u\left(\frac{1}{5}, 0.005\right)$ = ***.**1*

2) $u\left(\frac{1}{5}, 0.005\right)$ = ***.**6*

3) $u\left(\frac{1}{5}, 0.005\right)$ = ***.**0*

4) $u\left(\frac{1}{5}, 0.005\right)$ = ***.**2*

5) $u\left(\frac{1}{5}, 0.005\right)$ = ***.**7*

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<1,\ 0<t \\ u(0,t)=u(1,t)=0 & 0\le t \\ u(x,0)=3\,(x-1)\left(x-\frac{1}{2}\right)\left(x-\frac{1}{10}\right)x & 0\le x\le 1 \\ \frac{\partial}{\partial t}u(x,0)=-3\,(x-1)\left(x-\frac{1}{10}\right)x^2 & 0.\le x\le 1 \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at $x=\frac{1}{10}$

and the moment $t=0.005$ by means of a Fourier series of order 8 .

1) $u\left(\frac{1}{10}, 0.005\right)$ = ***.***2

2) $u\left(\frac{1}{10}, 0.005\right)$ = ***.***1

3) $u\left(\frac{1}{10}, 0.005\right)$ = ***.***3

4) $u\left(\frac{1}{10}, 0.005\right)$ = ***.***5

5) $u\left(\frac{1}{10}, 0.005\right)$ = ***.***7

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 2

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=4\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<5,\ 0<t \\ u(0,t)=u(5,t)=0 & 0\leq t \\ u(x,0)=-2\,(x-5)\,(x-3)\,(x-1)\,x^2 & 0\leq x\leq 5 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point $x=4$ and the moment $t=0.008$ by means of a Fourier series of order 10 .

1) u (4 , 0.008) = *6*.****

2) u (4 , 0.008) = *9*.****

3) u (4 , 0.008) = *5*.****

4) u (4 , 0.008) = *8*.****

5) u (4 , 0.008) = *0*.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=4\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<5,\ 0<t \\ u(0,t)=u(5,t)=0,\ \mathrm{Lim}_{t\to\infty}u(x,t)=0 & 0\leq t \\ u(x,0)=-2\,(x-5)\,(x-3)\,(x-1)\,x^2 & 0\leq x\leq 5 \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point $x=2$, $t=0.007$, by separation of variables by means of a Fourier series of order 8.

1) u (2 , 0.007) = *8*.****

2) u (2 , 0.007) = *2*.****

3) u (2 , 0.007) = *0*.****

4) u (2 , 0.007) = *3*.****

5) u (2 , 0.007) = *1*.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 3

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t) = \frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<4,\ 0<t \\ u(0,t)=u(4,t)=0 & 0 \le t \\ u(x,0) = -3\,(x-4)^2\,(x-2)\,x & 0 \le x \le 4 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 1
and the moment t= 0.01 by means of a Fourier series of order 12 .

1) u(1 , 0.01) = *1*.****

2) u(1 , 0.01) = *2*.****

3) u(1 , 0.01) = *8*.****

4) u(1 , 0.01) = *7*.****

5) u(1 , 0.01) = *6*.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t) = \frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<4,\ 0<t \\ u(0,t)=u(4,t)=0,\ \mathrm{Lim}_{t\to\infty} u(x,t)=0 & 0 \le t \\ u(x,0) = -3\,(x-4)^2\,(x-2)\,x & 0 \le x \le 4 \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 3
, t= 0.002 , by separation of variables by means of a Fourier series of order 8.

1) u(3 , 0.002) = **5.****

2) u(3 , 0.002) = **9.****

3) u(3 , 0.002) = **2.****

4) u(3 , 0.002) = **7.****

5) u(3 , 0.002) = **6.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 4

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<5,\ 0<t \\ \frac{\partial u}{\partial x}(0,t)=\frac{\partial u}{\partial x}(5,t)=0 & 0\le t \\ u(x,0)=-(x-5)^2(x-3)(x-2)x & 0\le x\le 5 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 3
and the moment t= 0.006 by means of a Fourier series of order 10 .

1) u(3 , 0.006) = ***.3***

2) u(3 , 0.006) = ***.9***

3) u(3 , 0.006) = ***.0***

4) u(3 , 0.006) = ***.4***

5) u(3 , 0.006) = ***.7***

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<5,\ 0<t \\ u(0,t)=u(5,t)=0 & 0\le t \\ u(x,0)=-(x-5)^2(x-3)(x-2)x & 0\le x\le 5 \\ \frac{\partial}{\partial t}u(x,0)=3(x-5)^2(x-4)(x-2)x^2 & 0.\le x\le 5 \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 2
and the moment t= 0.01 by means of a Fourier series of order 12 .

1) u(2 , 0.01) = ***.2***

2) u(2 , 0.01) = ***.9***

3) u(2 , 0.01) = ***.5***

4) u(2 , 0.01) = ***.0***

5) u(2 , 0.01) = ***.3***

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 5

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t) = \frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t) = u(\pi,t) = 0 & 0 \le t \\ u(x,0) = -\left((x-2)\,x^2\,(x-\pi)\right) & 0 \le x \le \pi \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 1
and the moment t= 0.008 by means of a Fourier series of order 12 .

1) u (1 , 0.008) = **5.****

2) u (1 , 0.008) = **3.****

3) u (1 , 0.008) = **2.****

4) u (1 , 0.008) = **8.****

5) u (1 , 0.008) = **0.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t) = \frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t) = u(\pi,t) = 0 & 0 \le t \\ u(x,0) = -\left((x-2)\,x^2\,(x-\pi)\right) & 0 \le x \le \pi \\ \frac{\partial}{\partial t}u(x,0) = 3\,(x-3)\,(x-2)\,x^2\,(x-\pi) & 0. \le x \le \pi \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 1
and the moment t= 0.008 by means of a Fourier series of order 12 .

1) u (1 , 0.008) = **3.****

2) u (1 , 0.008) = **2.****

3) u (1 , 0.008) = **0.****

4) u (1 , 0.008) = **5.****

5) u (1 , 0.008) = **8.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 6

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t) = \frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<1,\ 0<t \\ u(0,t)=u(1,t)=0 & 0 \le t \\ u(x,0) = \begin{cases} -10\,x & 0 \le x \le \frac{3}{10} \\ \frac{30\,x}{7} - \frac{30}{7} & \frac{3}{10} \le x \le 1 \end{cases} & 0 \le x \le 1 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point $x=\frac{7}{10}$ and the moment $t=0.001$ by means of a Fourier series of order 12 .

1) $u\left(\frac{7}{10}, 0.001\right)$ = **9.****

2) $u\left(\frac{7}{10}, 0.001\right)$ = **2.****

3) $u\left(\frac{7}{10}, 0.001\right)$ = **7.****

4) $u\left(\frac{7}{10}, 0.001\right)$ = **5.****

5) $u\left(\frac{7}{10}, 0.001\right)$ = **1.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t) = \frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<1,\ 0<t \\ u(0,t) = u(1,t) = 0 & 0 \le t \\ u(x,0) = \begin{cases} -10\,x & 0 \le x \le \frac{3}{10} \\ \frac{30\,x}{7} - \frac{30}{7} & \frac{3}{10} \le x \le 1 \end{cases} & 0 \le x \le 1 \\ \frac{\partial}{\partial t} u(x,0) = 2\,(x-1)^2\left(x-\frac{3}{5}\right)x^2 & 0. \le x \le 1 \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at $x = \frac{2}{5}$ and the moment $t = 0.002$ by means of a Fourier series of order 8 .

1) $u\left(\frac{2}{5}, 0.002\right)$ = **0.****

2) $u\left(\frac{2}{5}, 0.002\right)$ = **4.****

3) $u\left(\frac{2}{5}, 0.002\right)$ = **5.****

4) $u\left(\frac{2}{5}, 0.002\right)$ = **1.****

5) $u\left(\frac{2}{5}, 0.002\right)$ = **2.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 7

Exercise 1

$$\begin{cases} (1+5t+2t^2)\frac{\partial u}{\partial t}(x,t)=25(5+4t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=\begin{cases} \frac{9x}{2} & 0\le x\le 2 \\ -\frac{9x}{\pi-2}+\frac{18}{\pi-2}+9 & 2\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 1 , t= 0.001 , by separation of variables by means of a Fourier series of order 11.

1) u(1 , 0.001) = **6.****

2) u(1 , 0.001) = **4.****

3) u(1 , 0.001) = **3.****

4) u(1 , 0.001) = **5.****

5) u(1 , 0.001) = **2.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=25\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0,\ \mathrm{Lim}_{t\to\infty}u(x,t)=0 & 0\le t \\ u(x,0)=\begin{cases} 9x & 0\le x\le 1 \\ 10-x & 1\le x\le 3 \\ -\frac{7x}{\pi-3}+\frac{21}{\pi-3}+7 & 3\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 2 , t= 0.004 , by separation of variables by means of a Fourier series of order 8.

1) u(2 , 0.004) = **3.****

2) u(2 , 0.004) = **2.****

3) u(2 , 0.004) = **4.****

4) u(2 , 0.004) = **7.****

5) u(2 , 0.004) = **6.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 8

Exercise 1

$$\begin{cases} (1+2t+t^2)\frac{\partial u}{\partial t}(x,t)=25(2\ +\ 2\ t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=-((x-1)\ x\ (x-\pi)) & 0\le x\le\pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 2 , t= 0.003 , by separation of variables by means of a Fourier series of order 11.

1) u(2 , 0.003) = **5.****

2) u(2 , 0.003) = **3.****

3) u(2 , 0.003) = **7.****

4) u(2 , 0.003) = **1.****

5) u(2 , 0.003) = **9.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=25\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0,\ \text{Lim}_{t->\infty}u(x,t)=0 & 0\le t \\ u(x,0)=\begin{cases} x & 0\le x\le 1 \\ \frac{3x}{2}-\frac{1}{2} & 1\le x\le 3 \\ -\frac{4x}{\pi-3}+\frac{12}{\pi-3}+4 & 3\le x\le\pi \end{cases} & 0\le x\le\pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 2 , t= 0.001 , by separation of variables by means of a Fourier series of order 10.

1) u(2 , 0.001) = **7.****

2) u(2 , 0.001) = **2.****

3) u(2 , 0.001) = **8.****

4) u(2 , 0.001) = **5.****

5) u(2 , 0.001) = **0.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 9

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=16\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ \frac{\partial u}{\partial x}(0,t)=\frac{\partial u}{\partial x}(\pi,t)=0 & 0\le t \\ u(x,0)=2\,(x-3)\,x^2\,(x-\pi)^2 & 0\le x\le\pi \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 1
and the moment t= 0.007 by means of a Fourier series of order 12 .

1) u(1 , 0.007) = *5*.****

2) u(1 , 0.007) = *8*.****

3) u(1 , 0.007) = *4*.****

4) u(1 , 0.007) = *1*.****

5) u(1 , 0.007) = *6*.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=16\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=2\,(x-3)\,x^2\,(x-\pi)^2 & 0\le x\le\pi \\ \frac{\partial}{\partial t}u(x,0)=\begin{cases} 5x & 0\le x\le 1 \\ \frac{21}{2}-\frac{11x}{2} & 1\le x\le 3 \\ \frac{6x}{\pi-3}-\frac{18}{\pi-3}-6 & 3\le x\le\pi \end{cases} & 0.\le x\le\pi \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 2
and the moment t= 0.003 by means of a Fourier series of order 9 .

1) u(2 , 0.003) = *0*.****

2) u(2 , 0.003) = *9*.****

3) u(2 , 0.003) = *1*.****

4) u(2 , 0.003) = *8*.****

5) u(2 , 0.003) = *3*.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 10

Exercise 1

$$\begin{cases} (1+4t+2t^2)\frac{\partial u}{\partial t}(x,t)=16(4\ +\ 4\ t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=-\left((x-3)\ x^2\ (x-\pi)^2\right) & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 1 , t= 0.01 , by separation of variables by means of a Fourier series of order 12.

1) u(1 , 0.01) = **8.****

2) u(1 , 0.01) = **6.****

3) u(1 , 0.01) = **0.****

4) u(1 , 0.01) = **9.****

5) u(1 , 0.01) = **3.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=16\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0,\ \text{Lim}_{t\to\infty}u(x,t)=0 & 0\le t \\ u(x,0)=\begin{cases} -x & 0\le x\le 1 \\ 6\ x-7 & 1\le x\le 2 \\ -\frac{5\ x}{\pi-2}+\frac{10}{\pi-2}+5 & 2\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 1 , t= 0.009 , by separation of variables by means of a Fourier series of order 10.

1) u(1 , 0.009) = ***.5***

2) u(1 , 0.009) = ***.9***

3) u(1 , 0.009) = ***.2***

4) u(1 , 0.009) = ***.6***

5) u(1 , 0.009) = ***.0***

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 11

Exercise 1

$$\begin{cases} (1+3t+2t^2)\frac{\partial u}{\partial t}(x,t)=25(3\ +\ 4\ t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<4,\ 0<t \\ u(0,t)=u(4,t)=0 & 0\le t \\ u(x,0)=3\ (x-4)\ (x-2)\ (x-1)\ x & 0\le x\le 4 \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point $x=2$, $t=0.01$, by separation of variables by means of a Fourier series of order 10.

1) u(2 , 0.01) = **1.****

2) u(2 , 0.01) = **9.****

3) u(2 , 0.01) = **7.****

4) u(2 , 0.01) = **2.****

5) u(2 , 0.01) = **4.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=25\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<4,\ 0<t \\ u(0,t)=u(4,t)=0,\ \mathrm{Lim}_{t\to\infty}u(x,t)=0 & 0\le t \\ u(x,0)=(x-4)\ (x-3)\ (x-2)\ x^2 & 0\le x\le 4 \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point $x=3$, $t=0.004$, by separation of variables by means of a Fourier series of order 10.

1) u(3 , 0.004) = ***.3***

2) u(3 , 0.004) = ***.4***

3) u(3 , 0.004) = ***.6***

4) u(3 , 0.004) = ***.8***

5) u(3 , 0.004) = ***.2***

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 12

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t) = 9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ \frac{\partial u}{\partial x}(0,t) = \frac{\partial u}{\partial x}(\pi,t) = 0 & 0 \le t \\ u(x,0) = \begin{cases} \frac{5x}{2} & 0 \le x \le 2 \\ 31 - 13x & 2 \le x \le 3 \\ \frac{8x}{\pi-3} - \frac{24}{\pi-3} - 8 & 3 \le x \le \pi \end{cases} & 0 \le x \le \pi \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point $x = 2$ and the moment $t = 0.001$ by means of a Fourier series of order 9 .

1) u(2 , 0.001) = **9.****

2) u(2 , 0.001) = **0.****

3) u(2 , 0.001) = **8.****

4) u(2 , 0.001) = **3.****

5) u(2 , 0.001) = **1.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t) = 9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t) = u(\pi,t) = 0 & 0 \le t \\ u(x,0) = \begin{cases} \frac{5x}{2} & 0 \le x \le 2 \\ 31 - 13x & 2 \le x \le 3 \\ \frac{8x}{\pi-3} - \frac{24}{\pi-3} - 8 & 3 \le x \le \pi \end{cases} & 0 \le x \le \pi \\ \frac{\partial}{\partial t}u(x,0) = \begin{cases} -4x & 0 \le x \le 2 \\ \frac{8x}{\pi-2} - \frac{16}{\pi-2} - 8 & 2 \le x \le \pi \end{cases} & 0. \le x \le \pi \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at $x = 1$ and the moment $t = 0.001$ by means of a Fourier series of order 8 .

1) u(1 , 0.001) = **9.****

2) u(1 , 0.001) = **6.****

3) u(1 , 0.001) = **2.****

4) u(1 , 0.001) = **1.****

5) u(1 , 0.001) = **8.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 13

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=\begin{cases} x & 0\le x\le 1 \\ 2x-1 & 1\le x\le 3 \\ -\frac{5x}{\pi-3}+\frac{15}{\pi-3}+5 & 3\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 2
and the moment t= 0.005 by means of a Fourier series of order 8 .

1) u(2 , 0.005) = **3.****

2) u(2 , 0.005) = **6.****

3) u(2 , 0.005) = **4.****

4) u(2 , 0.005) = **7.****

5) u(2 , 0.005) = **1.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=\begin{cases} x & 0\le x\le 1 \\ 2x-1 & 1\le x\le 3 \\ -\frac{5x}{\pi-3}+\frac{15}{\pi-3}+5 & 3\le x\le \pi \end{cases} & 0\le x\le \pi \\ \frac{\partial}{\partial t}u(x,0)=-\left((x-1)\,x^2\,(x-\pi)\right) & 0.\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 2
and the moment t= 0.009 by means of a Fourier series of order 12 .

1) u(2 , 0.009) = **3.****

2) u(2 , 0.009) = **1.****

3) u(2 , 0.009) = **6.****

4) u(2 , 0.009) = **7.****

5) u(2 , 0.009) = **0.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 14

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=16\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<4,\ 0<t \\ \frac{\partial u}{\partial x}(0,t)=\frac{\partial u}{\partial x}(4,t)=0 & 0\le t \\ u(x,0)=\begin{cases} -9x & 0\le x\le 1 \\ 3x-12 & 1\le x\le 4 \end{cases} & 0\le x\le 4 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 3
and the moment t= 0.006 by means of a Fourier series of order 9 .

1) u(3 , 0.006) = **1.****

2) u(3 , 0.006) = **9.****

3) u(3 , 0.006) = **3.****

4) u(3 , 0.006) = **0.****

5) u(3 , 0.006) = **5.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=16\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<4,\ 0<t \\ u(0,t)=u(4,t)=0 & 0\le t \\ u(x,0)=\begin{cases} -9x & 0\le x\le 1 \\ 3x-12 & 1\le x\le 4 \end{cases} & 0\le x\le 4 \\ \frac{\partial}{\partial t}u(x,0)=3\,(x-4)^2\,(x-3)\,(x-2)\,x & 0.\le x\le 4 \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 1
and the moment t= 0.005 by means of a Fourier series of order 10 .

1) u(1 , 0.005) = **6.****

2) u(1 , 0.005) = **5.****

3) u(1 , 0.005) = **8.****

4) u(1 , 0.005) = **3.****

5) u(1 , 0.005) = **0.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 15

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ \frac{\partial u}{\partial x}(0,t)=\frac{\partial u}{\partial x}(\pi,t)=0 & 0\le t \\ u(x,0)=\begin{cases} x & 0\le x\le 1 \\ -\frac{x}{\pi-1}+\frac{1}{\pi-1}+1 & 1\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 2
and the moment t= 0.009 by means of a Fourier series of order 12 .

1) u(2 , 0.009) = ***.4***

2) u(2 , 0.009) = ***.5***

3) u(2 , 0.009) = ***.9***

4) u(2 , 0.009) = ***.8***

5) u(2 , 0.009) = ***.6***

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=\begin{cases} x & 0\le x\le 1 \\ -\frac{x}{\pi-1}+\frac{1}{\pi-1}+1 & 1\le x\le \pi \end{cases} & 0\le x\le \pi \\ \frac{\partial}{\partial t}u(x,0)=\begin{cases} 2x & 0\le x\le 1 \\ 10-8x & 1\le x\le 2 \\ \frac{6x}{\pi-2}-\frac{12}{\pi-2}-6 & 2\le x\le \pi \end{cases} & 0.\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 2
and the moment t= 0.01 by means of a Fourier series of order 9 .

1) u(2 , 0.01) = ***.8***

2) u(2 , 0.01) = ***.5***

3) u(2 , 0.01) = ***.1***

4) u(2 , 0.01) = ***.4***

5) u(2 , 0.01) = ***.3***

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 16

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t) = 4\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<2,\ 0<t \\ u(0,t) = u(2,t) = 0 & 0 \le t \\ u(x,0) = \begin{cases} 6x & 0 \le x \le 1 \\ 12 - 6x & 1 \le x \le 2 \end{cases} & 0 \le x \le 2 \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point $x = \frac{9}{10}$

and the moment $t = 0.009$ by means of a Fourier series of order 12 .

1) $u\left(\frac{9}{10}, 0.009\right)$ = **5.****

2) $u\left(\frac{9}{10}, 0.009\right)$ = **7.****

3) $u\left(\frac{9}{10}, 0.009\right)$ = **4.****

4) $u\left(\frac{9}{10}, 0.009\right)$ = **0.****

5) $u\left(\frac{9}{10}, 0.009\right)$ = **2.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t) = 4\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<2,\ 0<t \\ u(0,t) = u(2,t) = 0 & 0 \le t \\ u(x,0) = \begin{cases} 6x & 0 \le x \le 1 \\ 12-6x & 1 \le x \le 2 \end{cases} & 0 \le x \le 2 \\ \frac{\partial}{\partial t}u(x,0) = \begin{cases} 7x & 0 \le x \le 1 \\ 14-7x & 1 \le x \le 2 \end{cases} & 0. \le x \le 2 \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at $x=\frac{9}{10}$

and the moment $t=0.009$ by means of a Fourier series of order 12 .

1) $u\left(\frac{9}{10}, 0.009\right)$ = **7.****

2) $u\left(\frac{9}{10}, 0.009\right)$ = **0.****

3) $u\left(\frac{9}{10}, 0.009\right)$ = **2.****

4) $u\left(\frac{9}{10}, 0.009\right)$ = **4.****

5) $u\left(\frac{9}{10}, 0.009\right)$ = **5.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 17

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=16(1+9t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=2(x-2)\,x^2\,(x-\pi)^2 & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 1 , t= 0.006 , by separation of variables by means of a Fourier series of order 11.

1) u(1 , 0.006) = **8.****

2) u(1 , 0.006) = **1.****

3) u(1 , 0.006) = **0.****

4) u(1 , 0.006) = **6.****

5) u(1 , 0.006) = **2.****

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=16\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0,\ \mathrm{Lim}_{t\to\infty}u(x,t)=0 & 0\le t \\ u(x,0)=\begin{cases} \frac{7x}{3} & 0\le x\le 3 \\ -\frac{7x}{\pi-3}+\frac{21}{\pi-3}+7 & 3\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 2 , t= 0.008 , by separation of variables by means of a Fourier series of order 8.

1) u(2 , 0.008) = **0.****

2) u(2 , 0.008) = **7.****

3) u(2 , 0.008) = **4.****

4) u(2 , 0.008) = **1.****

5) u(2 , 0.008) = **3.****

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 18

Exercise 1

$$\begin{cases} (1+9t+t^2)\frac{\partial u}{\partial t}(x,t)=25(9\ +\ 2\ t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=\begin{cases} -3x & 0\le x\le 2 \\ x-8 & 2\le x\le 3 \\ \frac{5x}{\pi-3}-\frac{15}{\pi-3}-5 & 3\le x\le \pi \end{cases} & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point $x=1$, $t=0.007$, by separation of variables by means of a Fourier series of order 8.

1) u (1 , 0.007) = ***.5***

2) u (1 , 0.007) = ***.1***

3) u (1 , 0.007) = ***.0***

4) u (1 , 0.007) = ***.3***

5) u (1 , 0.007) = ***.9***

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=25\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0,\ \text{Lim}_{t\to\infty}u(x,t)=0 & 0\le t \\ u(x,0)=-\left((x-3)\ (x-2)\ x\ (x-\pi)^2\right) & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point $x=2$, $t=0.006$, by separation of variables by means of a Fourier series of order 11.

1) u (2 , 0.006) = ***.4***

2) u (2 , 0.006) = ***.0***

3) u (2 , 0.006) = ***.3***

4) u (2 , 0.006) = ***.8***

5) u (2 , 0.006) = ***.5***

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 19

Exercise 1

$$\begin{cases} (1+t+3t^2)\frac{\partial u}{\partial t}(x,t)=4(1+6t)\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=2\,(x-3)\,(x-1)\,x\,(x-\pi)^2 & 0\le x\le\pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 1 , t= 0.003 , by separation of variables by means of a Fourier series of order 8.

1) u(1 , 0.003) = ***.1***

2) u(1 , 0.003) = ***.0***

3) u(1 , 0.003) = ***.5***

4) u(1 , 0.003) = ***.9***

5) u(1 , 0.003) = ***.8***

Exercise 2

$$\begin{cases} \frac{\partial^3 u}{\partial t^3}(x,t)=4\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0,\ \mathrm{Lim}_{t\to\infty}u(x,t)=0 & 0\le t \\ u(x,0)=(x-3)\,(x-1)\,x\,(x-\pi) & 0\le x\le\pi \\ 0 & \text{True} \end{cases}$$

Compute the value of the solution of this boundary problem at the point x= 1 , t= 0.003 , by separation of variables by means of a Fourier series of order 8.

1) u(1 , 0.003) = ***.**2*

2) u(1 , 0.003) = ***.**0*

3) u(1 , 0.003) = ***.**5*

4) u(1 , 0.003) = ***.**9*

5) u(1 , 0.003) = ***.**8*

Further Mathematics - Degree in Engineering - 2025/2026
5-Fourier-PDE-Computers-training for serial number: 20

Exercise 1

$$\begin{cases} \frac{\partial u}{\partial t}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ \frac{\partial u}{\partial x}(0,t)=\frac{\partial u}{\partial x}(\pi,t)=0 & 0\le t \\ u(x,0)=-3\,(x-2)\,(x-1)\,x\,(x-\pi)^2 & 0\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the temperature of the bar at the point x= 1
and the moment t= 0.008 by means of a Fourier series of order 11 .

1) u(1 , 0.008) = **6.****

2) u(1 , 0.008) = **2.****

3) u(1 , 0.008) = **7.****

4) u(1 , 0.008) = **1.****

5) u(1 , 0.008) = **0.****

Exercise 2

$$\begin{cases} \frac{\partial^2 u}{\partial t^2}(x,t)=9\frac{\partial^2 u}{\partial x^2}(x,t) & 0<x<\pi,\ 0<t \\ u(0,t)=u(\pi,t)=0 & 0\le t \\ u(x,0)=-3\,(x-2)\,(x-1)\,x\,(x-\pi)^2 & 0\le x\le \pi \\ \frac{\partial}{\partial t}u(x,0)=3\,(x-2)\,x^2\,(x-\pi) & 0.\le x\le \pi \\ 0 & \text{True} \end{cases}$$

Compute the position of the string at x= 1
and the moment t= 0.01 by means of a Fourier series of order 9 .

1) u(1 , 0.01) = ***.0***

2) u(1 , 0.01) = ***.9***

3) u(1 , 0.01) = ***.6***

4) u(1 , 0.01) = ***.1***

5) u(1 , 0.01) = ***.8***