Solution Key

Question ID	Correct Answer(s)
1	(b)
2	(a)
3	(f)
4	(d)
5	(b)
6	(b)
7	(a) (e)
8	(d)
9	(d)
10	(a)

Question 1 **[1 points]**

Select one answer

This is a regular question without anything too fancy. What is the correct answer?

(a) ☐ Not the correct answer

(b) ☑ The correct answer

(c) ☐ Another wrong answer

(d) ☐ Yet another wrong answer

Correct Answer

Correct answer(s): b

Question Slug: 001_regular_question_example
Question ID: fdcf9509-879d-524c-8785-124b2097ebd9

Question 2 [1 points]

Select one answer

What does the below equation represent?

$$\phi(x) = \begin{cases} \alpha(e^x - 1) & \text{if} x < 0 \\ x & \text{if} x \geq 0 \end{cases} \tag{1}$$

(a) ☑ The Exponential Linear Unit (ELU) activation function

(b) ☐ The Schrödinger equation

(c) ☐ The Fourier transform

(d) ☐ The Cauchy-Riemann equations

Correct Answer

Correct answer(s): a

Question Slug: 002_math_question
Question ID: 895e08c6-73bd-560f-9863-d5fbb2b90bf5

Question 3 **[1 points]**

Select one answer

What is the correct formulation of the time-independent Schrödinger equation?

(a) ☐ $E = mc^2$

(b) ☐ $F = ma$

(c) ☐ $a^2 + b^2 = c^2$

(d) ☐ $V = IR$

(e) ☐ $pV = nRT$

(f) ☑ $-\frac{\hbar^2}{2m}\nabla^2\psi + V\psi = E\psi$

Correct Answer

Correct answer(s): f

Question Slug: 003_math_question_answers
Question ID: d9b07b62-c984-5397-88e4-c873c1a67d6a

Question 4 **[1 points]** ***Select <u>one</u> answer***

What is shown in the image?

Figure: The picture that goes with the question.

(a) ☐ A cute dog

(b) ☐ A german shepherd

(c) ☐ A beach

(d) ☑ All of the above

Correct Answer

Correct answer(s): d

Question Slug: 004_image_question
Question ID: d9cb954f-0eab-5d21-8f47-2797bf410c65

Question 5 [1 points]

Select one answer

Which image is taken in the capital city of France?

(a) Figure (a)

(b) Figure (b)

(c) Figure (c)

(d) Figure (d)

(a) ☐ Figure (a)
(b) ☑ Figure (b)
(c) ☐ Figure (c)
(d) ☐ Figure (d)

Correct Answer

Correct answer(s): b

Question 6 [1 points]

Select one answer

What does the code below do?

```python
def example_function(x):
    return x * 2
```

(a) ☐ Calculates the square of the input value

(b) ☑ Computes double the input value

(c) ☐ Returns the input value unchanged

(d) ☐ Finds the factorial of the input value

Correct Answer

Correct answer(s): b

Question Slug: 006_example_question_with_code
Question ID: 8601325f-cfca-5fe2-a5ac-2cac75afc699

Question 7 [1 points]

Select <u>all</u> correct answers

Which code snippets implements a function that returns the square of a number?

```python
def square(x):
    return x * x
```

```python
def square(x):
    return x + x
```

```python
def square(x):
    return x ** 3
```

```python
def square(x):
    return x - x
```

```python
def square(x):
    return x**2
```

(a) ☑ First code snippet

(b) ☐ Second code snippet

(c) ☐ Third code snippet

(d) ☐ Fourth code snippet

(e) ☑ Fifth code snippet

Correct Answer

Correct answer(s): a, e

Question Slug: 007_code_multi_question
Question ID: 2e901a8f-8777-5873-babe-68adfea8a6cb

Question 8 [1 points] *Select <u>one</u> answer*

In line 12 of the following code snippet, what is the meaning of `x` and `edge_index`?

```python
1  import torch
2  import torch.nn.functional as F
3  from torch_geometric.nn import GCNConv
4
5  class GCN(torch.nn.Module):
6      def __init__(self):
7          super().__init__()
8          self.conv1 = GCNConv(dataset.num_node_features, 16)
9          self.conv2 = GCNConv(16, dataset.num_classes)
10
11     def forward(self, data):
12         x, edge_index = data.x, data.edge_index
13
14         x = self.conv1(x, edge_index)
15         x = F.relu(x)
16         x = F.dropout(x, training=self.training)
17         x = self.conv2(x, edge_index)
18
19         return F.log_softmax(x, dim=1)
```

(a) ☐ They are the input features and edge indices of the graph data, respectively.

(b) ☐ They are the output features and edge indices of the graph data, respectively.

(c) ☐ They are the weights and biases of the GCN layer, respectively.

(d) ☑ They are the node features and edge indices of the graph data, respectively.

(e) ☐ They are the activation functions applied to the graph data, respectively.

Correct Answer

Correct answer(s): d

Question Slug: code_heavy_question
Question ID: 79362d84-c76d-5904-ac1c-58a28904cd8f

Question 9 [1 points]

Select one answer

In the following Rust code snippet, what happens when the function `main` is called?

```rust
fn drink(beverage: &str) {
    // You shouldn't drink too many sugary beverages.
    if beverage == "lemonade" { panic!("AAAaaaaa!!!!"); }

    println!("Some refreshing {} is all I need.", beverage);
}

fn main() {
    drink("water");
    drink("lemonade");
    drink("still water");
}
```

(a) ☐ The program prints a message and successfully drinks all beverages.

(b) ☐ The program panics immediately without printing any message.

(c) ☐ The program prints a message for water and still water, but panics when trying to drink lemonade.

(d) ☑ The program prints a message for water, but panics when trying to drink lemonade and exits before reaching still water.

Correct Answer

Correct answer(s): d

Question Slug: code_rust_question
Question ID: d5f80db3-d6e5-55c3-a174-124fc16b6d2b

Question 10 [1 points]

Select one answer

Consider the following partial differential equation describing heat diffusion in a non-uniform medium:

$$\frac{\partial u}{\partial t} = \nabla \cdot (\kappa(\mathbf{x}, t)\nabla u) + f(\mathbf{x}, t)$$

where $u(\mathbf{x}, t)$ is the temperature field, $\kappa(\mathbf{x}, t)$ is the spatially and temporally dependent thermal conductivity, and $f(\mathbf{x}, t)$ is a heat source term. Given the boundary condition $u(\mathbf{x}, 0) = u_0(\mathbf{x})$ and the Green's function solution:

$$u(\mathbf{x}, t) = \int_\Omega G(\mathbf{x}, \mathbf{y}, t)u_0(\mathbf{y})\, d\mathbf{y} + \int_0^t \int_\Omega G(\mathbf{x}, \mathbf{y}, t - \tau)f(\mathbf{y}, \tau)\, d\mathbf{y}\, d\tau$$

Which statement best describes the physical interpretation of this solution?

(a) ☑ The first integral represents the response to initial conditions; the second represents accumulated heat sources over time

(b) ☐ Both integrals represent only the effect of boundary conditions

(c) ☐ The solution requires κ to be constant throughout the domain

(d) ☐ The Green's function is independent of the heat source term f

Explanation and Correct Answer

Correct answer(s): a

This is the superposition principle for linear PDEs. The first integral:

$$\int_\Omega G(\mathbf{x}, \mathbf{y}, t)u_0(\mathbf{y})\, d\mathbf{y}$$

describes how the initial temperature distribution $u_0(\mathbf{y})$ propagates through the domain via the Green's function $G(\mathbf{x}, \mathbf{y}, t)$.

The second integral:

$$\int_0^t \int_\Omega G(\mathbf{x}, \mathbf{y}, t - \tau)f(\mathbf{y}, \tau)\, d\mathbf{y}\, d\tau$$

represents Duhamel's principle: the cumulative effect of heat sources $f(\mathbf{y}, \tau)$ occurring at all past times τ and locations $\mathbf{y}$.

Question Slug: complex-pde-equation
Question ID: b2023dab-3f6a-53ee-8dde-5d04d241d352