1. On-Line Exercises

The `exercise` environment makes it easy to produce electronic exercises.

By using the `forpaper` option, you can also make a paper version of your exercises.

EXERCISE 1. Evaluate the integral $\int x^2 e^{2x}\, dx$.

Problem 1.1. Is $F(t) = \sin(t)$ an antiderivative of $f(x) = \cos(x)$? Explain your reasoning.

There is a `*`-option with the `exercise` environment which signals the presence of a multiple part exercise question.

The following exercise illustrates this option.

EXERCISE 2. Suppose a particle is moving along the s-axis, and that its position at any time t is given by $s = t^2 - 5t + 1$.

(a) Find the velocity, v, of the particle at any time t.
(b) Find the acceleration, a, of the particle at any time t.

Part (a) is in blue; the solutions for that part is "hidden".

There is now an option for listing multipart question in tabular form.

EXERCISE 3. Simplify each of the following expressions in the complex number system. *Note*: $\bar{z}$ is the conjugate of z; $\operatorname{Re} z$ is the real part of z and $\operatorname{Im} z$ is the imaginary part of z.

(a) i^2
(b) i^3
(c) $z + \bar{z}$
(d) $1/z$

2. Short Quizzes with or without Solutions

Short quizzes are quizzes with immediate response.

As soon as the user enters an answer, that answer is immediately evaluated, the results of the evaluation are communicated to the user.

Solutions can optionally be included in each question.

Below is a `shortquiz` without solution.

Quiz Was it in Xanadu did Kubla Kahn a stately pleasure dome decree?

(a) True (b) False

Below is a `shortquiz` with a solution.

Quiz In what year did Columbus sail the ocean blue?

☐ 1490 ☐ 1491 ☐ 1492 ☐ 1493

These two types can be bundled together using the `questions` environment.

Quiz Answer each of the following. Passing is 100%.

1. Was it in Xanadu did Kubla Kahn a stately pleasure dome decree?

(a) True (b) False

2. In what year did Columbus sail the ocean blue?

(a) 1490 (b) 1491 (c) 1492 (d) 1493

3. Graded Quizzes with JavaScript

You can create graded quizzes using the `quiz` environment.

Here is a graded quiz using simple links. This might be suitable for a limited number of questions.

Begin Quiz Using the discriminant, $b^2 - 4ac$, respond to each of the following questions.

1. Is the quadratic polynomial $x^2 - 4x + 3$ irreducible?
   (a) Yes (b) No
2. Is the quadratic polynomial $2x^2 - 4x + 3$ irreducible?
   (a) Yes (b) No
3. How many solutions does the equation $2x^2 - 3x - 2 = 0$ have?
   (a) none (b) one (c) two

End Quiz

Score:

Another one is a graded quiz using check boxes.

Begin Quiz Using the discriminant, $b^2 - 4ac$, respond to each of the following questions.

1. Is the quadratic polynomial $x^2 - 4x + 3$ irreducible?

☐ Yes

☐ No

2. Is the quadratic polynomial $2x^2 - 4x + 3$ irreducible?

☐ Yes ☐ No

3. How many solutions does the equation $2x^2 - 3x - 2 = 0$ have?

☐ none ☐ one ☐ two

End Quiz Score:

4. Correcting Quizzes with JavaScript

In this section, we illustrate the `quiz` environment with corrections.

There are two types: link-style and form-style.

This is the link-style format:

Begin Quiz Answer each of the following. Passing is 100%.

1. Who created TEX?

(a) Knuth (b) Lamport (c) Carlisle (d) Rahtz

2. Who originally wrote LATEX?

(a) Knuth (b) Lamport (c) Carlisle (d) Rahtz

End Quiz

Score: Correct

We can obtain the forms-style quiz simply by inserting an * before the quiz field name.

Begin Quiz Answer each of the following. Passing is 100%.

1. Who created TEX?

☐ Knuth ☐ Lamport ☐ Carlisle ☐ Rahtz

Solution: Yes, it was Donald Knuth who first created TEX.

End Quiz

2. Who originally wrote LATEX?

☐ Knuth ☐ Lamport ☐ Carlisle ☐ Rahtz

Solution: Yes, it was Leslie Lamport who first created TEX.

End Quiz

End Quiz Score: Correct

The "corrections" button can be modified to take on a different look.

5. Objective-Style Questions

It is also possible to pose objective-style questions (fill-in-the-blank).

There are two kinds of such questions

- text fill-in questions
- math fill-in questions

Begin Quiz Answer each of the following. Passing is 100%.

1. Name *one* of the two people recognized as a founder of Calculus.

2. $\frac{\mathrm{d}}{\mathrm{d}x} e^{x^2} =$

End Quiz Score: Correct

Answers:

More examples

Begin Quiz Answer each of the following. Passing is 100%.

1. (6pts) If $\lim_{x\to a} f(x) = f(a)$, then we say that f is...

☐ differentiable ☐ continuous ☐ integrable

2. (6pts) Name *one* of the two people recognized as a founder of Calculus.

3. (8pts) $\dfrac{\mathrm{d}}{\mathrm{d}x} e^{x^2} =$

End Quiz Score: Correct

Answers:

Points: Percent:

Letter Grade:

Solutions to Exercises

Exercise 1. We evaluate by `integration by parts`:

$$\begin{aligned}
\int x^2 e^{2x}\,dx &= \tfrac{1}{2}x^2e^{2x} - \int xe^{2x}\,dx && u = x^2,\ dv = e^{2x}\,dx \\
&= \tfrac{1}{2}x^2e^{2x} - \left[\tfrac{1}{2}xe^{2x} - \int \tfrac{1}{2}e^{2x}\,dx\right] && \text{integration by parts} \\
&= \tfrac{1}{2}x^2e^{2x} - \tfrac{1}{2}xe^{2x} + \tfrac{1}{2}\int e^{2x}\,dx && u = x^2,\ dv = e^{2x}\,dx \\
&= \tfrac{1}{2}x^2e^{2x} - \tfrac{1}{2}xe^{2x} + \tfrac{1}{4}e^{2x} && \text{integration by parts} \\
&= \tfrac{1}{4}(2x^2 - 2x + 1)e^{2x} && \text{simplify!}
\end{aligned}$$

Exercise 1

Problem 1.1. The answer is yes. The definition states that F is an antiderivative of f if $F'(x) = f(x)$. Note that

$$F(t) = \sin(t) \implies F'(t) = \cos(t)$$

hence, $F(x) = \cos(x) = f(x)$. ◀

Exercise 2(b) Acceleration is the rate of change of velocity with respect to time. Thus,

$$a = \frac{dv}{dt}$$

For our problem, we have

$$a = \frac{dv}{dt} = \frac{d}{dt}(2t - 5) = 2.$$

The acceleration at time t is constant: $\boxed{a = 2}$. □

Exercise 3(a) $i^2 = -1$ □

Exercise 3(b) $i^3 = ii^2 = -i$ □

Exercise 3(c) $z + \bar{z} = \operatorname{Re} z$ □

Solutions to Quizzes

Solution to Quiz:

In 1492,
Columbus sailed the ocean blue.

Profound was the logic in his quest,
to get to the east, he headed west.[1]

End Quiz

[1] This poem was obtained by personal communication from Leonard A. Stefanski, Department of Statistics, North Carolina State University.

Solution to Quiz:

In 1492,
Columbus sailed the ocean blue.

Profound was the logic in his quest,
to get to the east, he headed west.[2]

End Quiz

[2]This poem was obtained by personal communication from Leonard A. Stefanski, Department of Statistics, North Carolina State University.

Solution to Quiz: Isaac Newton and Gottfried Leibniz are the co-creators of Calculus. End Quiz

Solution to Quiz: First apply the rule for differentiating an the natural exponential, then apply the power rule:

$$\begin{aligned}\frac{d}{dx}\, e^{x^2} &= e^{x^2}\, \frac{d}{dx}\, x^2 \\ &= e^{x^2}\, (2x) \\ &= 2xe^{x^2}\end{aligned}$$

End Quiz

Solution to Quiz: A function f is said to be continuous at $x = a$ if $x \in \text{Dom}(f)$, $\lim_{x \to a} f(x)$ exists and $\lim_{x \to a} f(x) = f(a)$.

End Quiz

Solution to Quiz: Isaac Newton and Gottfried Leibniz are the co-creators of Calculus. End Quiz

Solution to Quiz: First apply the rule for differentiating an the natural exponential, then apply the power rule:

$$\begin{aligned}\frac{d}{dx}\, e^{x^2} &= e^{x^2}\, \frac{d}{dx}\, x^2 \\ &= e^{x^2}\, (2x) \\ &= 2xe^{x^2}\end{aligned}$$

End Quiz