Panel 1

Science Calculus 1

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Please download and install Dyalog

Server: vision.dyknow.com / username

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Grading

Quizzes every week: 100 points
3 exams: 300 points
1 final: 100 points
Computer assignments: 100 points

600 points

Course Content:

- Functions, limits, continuity
- Derivatives
- Applications
- Integration
- Inverse functions
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**Functions**

**Def.** A function is a rule that assigns to each element \( x \) in a set \( A \) exactly one element \( y \), or more commonly \( y = f(x) \), in a set \( B \).

*Note:* The set \( A \) is called: **DOMAIN**

The set \( B \) is called: **RANGE**

\[ f(x) = x^2 \quad \text{Dom} = \mathbb{R} \]

\[ g(x) = \frac{1}{x-1} \quad \text{Dom} = \mathbb{R} - \{0\} \]

\[ k(x) = \sin \quad \text{Dom} = \mathbb{R} \]

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- Light bulb
- **f(x) = \frac{1}{x}**
- **Domain:** \( \mathbb{R} - \{0\} \)
- **Range:** \( \mathbb{R} - \{0\} \)
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$g(x) = ?$

Domain: $\mathbb{R}$

Range: $\{ y \geq -2 \}$

$[ -2, \infty )$

$\uparrow$ incl. \hspace{1cm} $\uparrow$ excl.

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Representing a function

- Verbally
- Numerically (table)
- Graphically
- Algebraically

4 different ways:

Ex: Domain of $f(x) = \sqrt{x+6}$: $x + 2 \geq 0$

$g(x) = \frac{1}{x^2 - x}$: $x \geq -2$ \hspace{1cm} Domain $\mathbb{R} - \{ 0, 1 \}$

Domain $x^2 - x = 0$ problem

$x(x-1) = 0$ \hspace{1cm} $\downarrow$ $x = 0 \hspace{1cm} x = 1$
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Sketch \( f(x) = x^2 - 1 \)

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Not every graph represents a function:

Vertical line test: if no vertical line intersects a graph more than once, it's a function.
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**Piecewise defined functions:**

\[
f(x) = \begin{cases} 
1-x & \text{if } x \leq 1 \\
x^2 & \text{if } x > 1 
\end{cases}
\]

- \( f(0) = 1 \)
- \( f(1) = 0 \)
- \( f(2) = 4 \)

Sketch this:

\[
\begin{aligned}
&1-x \\
x^2
\end{aligned}
\]

Is this right?

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\[
f(x) = \begin{cases} 
x + 2 & \text{if } x < -1 \\
x^2 + 2 & \text{if } x \geq -1 
\end{cases}
\]

- \( f(-2) = 0 \)
- \( f(-1) = 1 \)

Piece together.

\[
\begin{aligned}
x + 2 \\
x^2
\end{aligned}
\]
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A Function Catalog

- linear
- power \((x^2, x^3, x^4, x^5, x^6, 7x^7, 9x^8, \ldots)\)
- polynomials \((x^5 + 7x^2 - 9x + 103)\)
- rationals \(\frac{x-7}{x^2+9x+5}\) asymptotic
  \(\text{Roots}\)
- trig repeat \(e^r\) grows fast
- logs + exp close \(\ln(x)\) slows

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Who's Who?

1. linear
2. power
3. polynomial
4. rational
5. trig
6. exp
7. log
8. other
2. Polynomials

1. \( x^4 - 7x^2 + 9x \)
2. \( 5x^2 + 4x - 9 \)
3. \( -3x^4 + 2x - x \)
4. \( 5x - 9x^2 + 7x \)