Precalculus Section 1.2b

WARM-UP

(1) Simplify $\frac{2xh+h^2-4h}{h}$ $\frac{\cancel{h}(2x+h-4)}{\cancel{h}}$

(2) Evaluate $f(2), f(a), f(a+h)$ when $f(x)=2x^2-4x+3$

$f(2)=2(2)^2-4(2)+3=3$

$f(a)=2a^2-4a+3$

$f(a+h)=2(a+h)^2-4(a+h)+3$

$2(a^2+2ah+h^2)-4a-4h+3$

$\boxed{2a^2+4ah+2h^2-4a-4h+3}$

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WARM-UP

(1) Simplify $\frac{2xh+h^2-4h}{h}=\frac{\cancel{h}(2x+h-4)}{\cancel{h}}=\boxed{\begin{matrix}2x+h-4\\ \text{(as long as } h\neq 0)\end{matrix}}$

(2) Evaluate $f(2), f(a), f(a+h)$ when $f(x)=2x^2-4x+3$

$f(2)=2(2)^2-4(2)+3=2(4)-8+3=3$

$f(a)=2a^2-4a+3$

$f(a+h)=2(a+h)^2-4(a+h)+3=2(a^2+2ah+h^2)-4a-4h+3$

$=\boxed{2a^2+4ah+2h^2-4a-4h+3}$

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Questions from 1.2a?

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The Domain of a Function

The **implied domain** is the set of all real numbers (x's) for which the function (y) is defined.

THE 2 SCENARIOS TO WATCH OUT FOR for now**:**

- Any number that causes division by zero.
- Any number that causes a negative inside a square root (or fourth or sixth root, etc.)

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So when you see:

$f(x)=\dfrac{\text{anything}}{\quad}$ or $f(x)=\sqrt{\quad}$

Then you need to make sure:

den. ≠ 0

value ≥ 0

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Example
Find the domain of each function.

[A] $f:\{(-3,0),(-1,4),(0,2),(2,2),(4,-1)\}$

$D: \{-3,-1,0,2,4\}$

[B] $g(x)=-3x^2+4x+5$

$\mathbb{R}$ $(-\infty,\infty)$

[C] $h(x)=\dfrac{1}{x+5}$

$x \neq -5$

[D] $k(x)=\sqrt{4-3x}$

$4-3x \geq 0$

$-3x \geq -4$

$x \leq \frac{4}{3}$

$(-\infty, \frac{4}{3}]$

p. 26: 54, 56 (HW)

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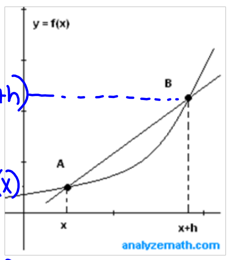
Difference Quotients
One of the most important concepts in calculus is **SLOPE**.

Q: How can we write the y-values of the points A and B?

A: $(x, f(x))$ $(x+h, f(x+h))$



$f(x+h)$

$f(x)$

Q: Write the slope of the line going through the points A and B.

A: $\dfrac{f(x+h)-f(x)}{x+h-x} = \dfrac{f(x+h)-f(x)}{h}, h \neq 0$

This ratio is called the DIFFERENCE QUOTIENT. It is SUPER IMPORTANT.

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$\dfrac{f(x+h)-f(x)}{h}$ *for* $h \neq 0$

1 2

Example 1
[A] Find the difference quotient for $f(x)=4x$.

① $f(x+h)=4(x+h)=4x+4h$

② $f(x)=4x$

③ Simplify

4 $h \neq 0$

$\boxed{\dfrac{4x+4h-4x}{h} = \dfrac{4\cancel{h}}{\cancel{h}} = 4}$

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[B] Find the difference quotient for $f(x)=x^2+x+5$.

1. $\frac{\boxed{f(3+h)}-f(3)}{h}$ 2.

① $f(3+h)=(3+h)^2+(3+h)+5$

$9+6h+h^2+3+h+5$

$h^2+7h+17$

② $f(3)=3^2+3+5$

$=9+3+5$

$=17$

③ Simplify

$\frac{h^2+7h+17-17}{h}$

$\frac{h^2+7h}{h}$

$\frac{\cancel{h}(h+7)}{\cancel{h}}$

$h+7;\ h\neq 0$

p. 29, #89 (HW)

Jan 17-12:09 PM

Example 2

$f(t)=\frac{1}{4+t}$ $\boxed{\frac{f(t)-f(1)}{t-1}}$ 2. $t\neq 1$ $t\neq -4$

① $f(t)=\frac{1}{4+t}$

② $f(1)=\frac{1}{4+1}=\frac{1}{5}$

$\frac{\frac{1}{4+t}-\frac{1}{5}}{t-1}$

num. $\frac{5-(4+t)}{5(4+t)}=\frac{5-4-t}{5(4+t)}$

$\frac{\frac{1-t}{5(4+t)}}{t-1}$

$\frac{1-t}{5(4+t)}\cdot\frac{1}{t-1}$

$\frac{-1(\cancel{-1+t})}{5(4+t)}\cdot\frac{1}{\cancel{t-1}}=\frac{-1}{5(4+t)}$

$t\neq 1,-4$

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Summary of Function Terminology

- Function: A **function** is a relationship between two variables such that to each value of the independent variable there corresponds exactly one value of the dependent variable.
- Function Notation: y=f(x)
  - f is the name of the function
  - y is the **dependent variable**
  - x is the **independent variable**
  - f(x) is the value of the function at x

CAUTION: f(x) does NOT mean f times x. It is simply notation for the y-value.

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HOMEWORK

...some difference quotients so you can become a calculus genius

1.2b (p.27): 74, 87-92, 99

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