CS 173, Spring 19 Examlet 1, white

Name:_____

NetID:_____ **Lecture: A B**

Discussion: Thursday Friday 9 10 11 12 1 2 3 4 5 6

1. (5 points) Multiply out and simplify, showing your work.
   $(x^{x-2} + x^2)^2 =$

   Solution:
   $(x^{x-2} + x^2)^2 = (x^{x-2})^2 + 2x^{x-2}x^2 + (x^2)^2 = x^{2x-4} + 2x^x + x^4$

2. (10 points) Check the (single) box that best characterizes each item.

   Shorthand for the set of integers. $\mathbb{J}$ ☐ $\mathbb{N}$ ☐ $\mathbb{W}$ ☐ $\mathbb{Z}$ ☑

   If $\sqrt{2}$ is rational, then -3 is positive. true ☑ false ☐ undefined ☐

   $\log_2 3 < \log_3 2$ true ☐ false ☑

   $(p \vee \neg p) \to q$ true ☐ false ☐ depends on q ☑

   $\neg(p \wedge \neg q) \equiv \neg p \vee q$ true ☑ false ☐

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1. (5 points) Simplify, showing your work.

   $\frac{\log_2(32^3)}{5} =$

   Solution: $\frac{\log_2(32^3)}{5} = \frac{3\log_2(32)}{5} = \frac{3\log_2(2^5)}{5} = \frac{3 \cdot 5}{5} = 3$

2. (10 points) Check the (single) box that best characterizes each item.

$\sqrt{2} \in \mathbb{Q}$	true ☐	false ☑
For all positive integers n, if $n! < 10$, then $n < 100$.	true ☑	false ☐
$a^{b^c} = (a^b)^c$	true ☐	false ☑
$p \wedge q \equiv \neg(p \rightarrow \neg q)$	true ☑	false ☐
For any real number x, $\lceil \lfloor x \rfloor \rceil = \lfloor x \rfloor$.	true ☑	false ☐

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1. (5 points) Simplify, showing your work.
   $\log_2(40) - \log_2(5) =$

   Solution: $\log_2(40) - \log_2(5) = \log_2(\frac{40}{5}) = \log_2 8 = 3$

2. (10 points) Check the (single) box that best characterizes each item.

   Shorthand for the set of rationals. $\mathbb{R}$ ☐ $\mathbb{F}$ ☐ $\mathbb{Q}$ ☑ $\mathbb{B}$ ☐

   Assume x is real.
   If $x^2 < 0$, then x is even. true ☑ false ☐ undefined ☐

   7 is a rational number true ☑ false ☐

   $(p \wedge q) \vee r \equiv (p \vee r) \wedge (q \vee r)$ true ☑ false ☐

   $\neg(\neg p \to \neg q) \equiv \neg p \wedge q$ true ☑ false ☐

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1. (5 points) Simplify, showing your work.

   $x - \dfrac{x^2 - 2}{x - \sqrt{2}} =$

   Solution: $x^2 - 2 = (x - \sqrt{2})(x + \sqrt{2})$

   So $\frac{x^2-2}{x-\sqrt{2}} = (x + \sqrt{2})$

   So $x - \frac{x^2-2}{x-\sqrt{2}} = x - (x + \sqrt{2}) = -\sqrt{2})$

2. (10 points) Check the (single) box that best characterizes each item.

$-5 \in \mathbb{Z}$	true	√	false			
$\exists n \in \mathbb{Z}$, $n \geq 3$ and $n \leq 3$.	true	√	false		undefined	
For some real number x, $\lceil x \rceil \leq \lfloor x \rfloor$.	true	√	false			
$(p \wedge \neg p) \rightarrow q$	true	√	false		depends on q	
For any real numbers x and y, if $x \leq y$, then $x^2 \leq y^2$.	true		false	√		

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1. (5 points) Simplify, showing your work.

   $\frac{1}{(\frac{1}{2})^4 + (-\frac{1}{2})^5} =$

   Solution: $\frac{1}{(\frac{1}{2})^4 + (-\frac{1}{2})^5} = \frac{1}{\frac{1}{16} - \frac{1}{32}} = \frac{1}{\frac{2-1}{32}} = \frac{1}{\frac{1}{32}} = 32$

2. (10 points) Check the (single) box that best characterizes each item.

   $0 \in \mathbb{Z}$ true [√] false [ ]

   If $\pi < 7$, then $3 < 1$ true [ ] false [√] undefined [ ]

   For any real number x, $2\lfloor x \rfloor \leq \lfloor 2x \rfloor$ true [√] false [ ]

   $\neg(p \to q) \equiv \neg p \to \neg q$ true [ ] false [√]

   $\binom{n}{k}$ $\frac{n}{k}$ [ ] $\frac{n!}{k!}$ [ ] $\frac{k!}{n!}$ [ ] $\frac{n!}{k!(n-k)!}$ [√] $\frac{n!}{k!(k-n)!}$ [ ]

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1. (5 points) Simplify, showing your work.

   $\frac{1}{(\frac{1}{2})^4 + (-\frac{1}{2})^6} =$

   Solution: $(\frac{1}{2})^4 + (-\frac{1}{2})^6 = (\frac{1}{2})^4 + (\frac{1}{2})^6 = 4(\frac{1}{2})^6 + (\frac{1}{2})^6 = 5\frac{1}{2})^6$

   So $\frac{1}{(\frac{1}{2})^4 + (-\frac{1}{2})^6} = \frac{1}{5(\frac{1}{2})^6} = \frac{1}{5}2^6$

2. (10 points) Check the (single) box that best characterizes each item.

   $0 \in \mathbb{Z}^+$ true ☐ false ☑

   For any integer x,
   if x is positive, then x is a real number. true ☑ false ☐

   $\log_5 7 < 1$ true ☐ false ☑

   $\exists n \in \mathbb{Z}$, such that $n^2 = 10$. true ☐ false ☑ undefined ☐

   $\exists n \in \mathbb{Z}$, such that $n^2 = 1$. true ☑ false ☐ undefined ☐

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1. (5 points) Simplify, showing your work.
   $\log_3(45x) - \log_3(5x) =$
   Solution: $\log_3(45x) - \log_3(5x) = \log_3 \frac{45x}{5x} = \log_3 9 = 2$

2. (10 points) Check the (single) box that best characterizes each item.

   $0 \in \mathbb{R}$ true [√] false [ ]

   If $\pi > 7$, then $3 < 1$ true [√] false [ ] undefined [ ]

   0! 0 [ ] 1 [√] -1 [ ] undefined [ ]

   $p \wedge \neg q \equiv \neg(p \to q)$ true [√] false [ ]

   2 is in the interval $(0, 2)$. true [ ] false [√]

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1. (5 points) Express $\frac{1}{2}[(2\log_2 a + \log_2 b) - 5\log_2 c]$ as a single logarithm.

   Solution: $\frac{1}{2}[(2\log_2 a + \log_2 b) - 5\log_2 c] = \frac{1}{2}[\log_2(a^2 b) - 5\log_2 c] = \frac{1}{2}(\log_2(\frac{a^2 b}{c^5})) = \log_2(\sqrt{\frac{a^2 b}{c^5}})$

2. (10 points) Check the (single) box that best characterizes each item.

$\sqrt{-1} \in \mathbb{C}$	true [√]	false [ ]
For any real number x, if $x > 10$, then $x^2 > 0$.	true [√]	false [ ]
For any integer x, $\lfloor x \rfloor = x$.	true [√]	false [ ]
$\neg(p \to q) \equiv \neg q \to \neg p$	true [ ]	false [√]
$5 \in \mathbb{Q}$	true [√]	false [ ]