Math 140 Practice Exam 1 /100

Exam 1. Lectures 1-6. Use provided scratch paper. No calculators. Understanding is not enough, you must develop enough proficiency to complete this exam in 50 minutes.

Tutoring available in Bilger Annex 209.

15. $\frac{2x}{x^3} < 1$ One interval
(b) $1 - \frac{1}{x} \leq \frac{2}{3x}$ A union of two intervals

5(6). Find the circle $x^2 - 2x + y^2 = 7$:
(a) Find the center and radius.
(b) Find the x and y-intercepts.

6(4). Find the equation for the line through (-1,-1) and (2,3).

7(5). Find the domain of $f(x) = \frac{1}{1-x^2}$ Union of two intervals.

8(6). Factor and find all roots given that -1 is one root.
$x^3 + x^2 - 3x - 3 = 0$

9(4). Simplify to a single polynomial:
$g(x) = x^3$. $[g(x+h) - g(x)]/h = \frac{3x^2}{h}$

10(3). For the function $h$ pictured,

for which values of $x$ does $h(x) = 0$?

11(14). For the domains and ranges, use interval notation, $[1,5]$, or set notation, $\{1,3,5\}$. The answer may be none.

<table>
<thead>
<tr>
<th>function</th>
<th>$1/x$</th>
<th>$\sqrt{x}$</th>
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<tbody>
<tr>
<td>domain</td>
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<td>interval(s) of decrease</td>
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12(6). Graph $f(x)$ where
$$f(x) = \begin{cases} 
1/x & \text{if } x < -1 \\
x & \text{if } -1 \leq x \leq 1 \\
1/x & \text{if } x > 1 
\end{cases}$$

13(4). Graph $1 - \sqrt{x+1}$.

14(6). The graph of $f(x)$ is a line segment from (0,2) to (2,0).
(a) Graph $y = -f(x+1)+1$. (b) Graph $y = f(1-x)-1$.

15(4). $f(x) = (1/x)+1$, $g(x) = (1/x)-1$, find and simplify $(f \circ g)(x)$.

16(2). $G(-4) = -3$, $G(-3) = 1$, $G(-1) = 2$, $G(1) = 5$.
$F(-3) = -4$, $F(1) = 3$, $F(2) = -1$, $F(5) = 1$. Find $(G \circ G \circ F)(1)$.

17(6). Write each function as a composition $f(g(x))$ of two simpler functions $f(x)$ and $g(x)$.
(a) $G(x) = x^4 + x^2 - 1$. (b) $F(x) = \frac{1}{\sqrt{x}} + \sqrt{x}$.

Answers
1. $3x - 7$
2. $(-\infty,-3) \cup (-1,\infty)$
3. $x = 4$. (not $x = -1$, it doesn't work in the original equation.)
4a. $(-3,3)$ 4b. $(-2,-1) \cup (0,2]$
5. (a) center = $(1,0)$, radius = $2\sqrt{2}$
(b) x-intercept: $1 \pm 2\sqrt{2}$, y-intercept: $\pm 7$
6. $y = \frac{4}{3}x + \frac{1}{3}$
7. $[-1,0) \cup (0,\infty)$
8. $(x + \sqrt{3})(x - \sqrt{3})(x+1)$ roots $\sqrt{3}, -1, -1, -1$.
9. $3x^2 + 3xh + h^2$
10. $x = 1, 9$
11. See homework problem Hw 4:7

12.

13.

14(a).

14(b).

15. $1/(1/x)-1+1 = 1/(1-x)$.

16. $G(G(F(1))) = G(G(-3)) = G(1) = 5$

17. (a) $G(x) = f(g(x))$ where $g(x) = x^2$ and $f(x) = x^2+x-1$.
(b) $F(x) = f(g(x))$ where $g(x) = \sqrt{x}$ and $f(x) = 1/x+x$.