MTH 229   Solutions to Final Exam Review Problems

1. a) $\sqrt{a - \frac{b}{c} - \frac{d}{e} - f^9 + h}$

   b) $\dfrac{\sin\left(\frac{x^2}{4}\right)}{2x^3}$

2. a) $\sin(4x)\wedge 2/(sqrt(2x)+2)$

   b) $atan(3x)/(exp(2x)-1)$

   $f(2.3) = 0.011986\ldots$

   $g(4.1) = 0.00040925\ldots$

3. $fzeros(f, 0, 2pi)$ $0, 1.7123, 4.8539$

4. a) $h(x) = x <= -1 ? \ 4-7/x\wedge2 : 3-1/x$

   b) $2.6174, \quad 2.6222$

5. a) 7   b) 4 max's for f,   3 max's for g

6. $h(x) = \cos(x) + 1.7/(x-pi)\wedge2$; $trimplot(h, 0, pi)$ (a) 1.637

7. $g(x) = x\wedge5 - 4x + 2$; $fzeros(g, -1000, 1000)$ $-1.5185\ldots$

8. $fzeros(h, -10, 10)$ returns $0.693147\ldots$,   but $fzero(h, -10, 10)$
   returns an error because $[-10, 10]$ is not a bracketing interval.
   In fact, the graph of $h(x)$ is tangent to the x-axis at $0.693147\ldots$

9. a) 0.9705 b) 2   c) 0.2231

10. a) $e^{-3/2}$ b) $\sqrt{5}/3$

11. a) $1.4286\ldots, 4.2666\ldots$ b) $0.9124\ldots, 3.3788\ldots$ c) 0.4086

12. $1.5707\ldots, 4.7123\ldots, 7.8539$.   Newton's Method with $x_0 = 6.1$ selects 1.57.
    6.1 is close to a critical point, so the tangent line intersects the x-axis near 2.

13. a) fzeros(f', 0, 10)   0.8925.., 4.0341.., 7.1757

    b) fzeros(f'', 0, 10)   2.7850.., 5.9266, 9.0682

14. a) fzeros(f', 5, 10)   5.6290.., 7.1697, 8.7242

    b) fzeros(f'', 5, 10)   6.5056, 8.0358, 9.5791

    c) $(5, 5.6290) \cup (7.1697, 8.7242)$

    d) $(6.5056, 8.0358) \cup (9.5791, 10)$

    e) min/max/min   f'(x) changes sign: $\begin{array}{c|c} \text{min} & \text{max} \\ -/+ & +/- \end{array}$

    f) f''(5.6290) > 0,   f''(7.1697) < 0,   f''(8.7242) > 0
    (signs taken from actual values)   use concavity to explain.

15. a) 2.2048, 2.1923, 2.198595, 2.19861

    b) 2.198595..

    c) error $\leq 9.41 \cdot 10^{-10}$

    d) Simpson's. The other answers are not within the error
       bound given by quadgk.