MA 134 Study Guide Key, Fall 2009

1. (Section 2.3, Section 3.6) *a*) $x = -3 \pm i\sqrt{3}$ *b*) $x = 2 \pm 2\sqrt{3}$ *c*) $x = \frac{1}{2} \pm \frac{3}{2}i$ *d*) $x = 3,\ x = -2 \pm \sqrt{3}$

e) (-3,0) ∪ (1, ∞) *f*) ((-∞,2] ∪ (1,3)

2. (Section 1.1, Section 7.2) $(x-3)^2 + (y+2)^2 = 5$

3. (Section 7.2) *a*) Center (3,-5), radius $\sqrt{35}$ *b*) Center(3,-2), r = 5 *c*) Center (3,-2), r = 6

4. (Sections 1.7, 4.2, 4.3) *a*) Basic graph $y = x^3$, reflected in *x*-axis, vertically compressed by a factor of $\frac{1}{3}$, shifted up 4, with domain and range (-∞,∞) . Points (0,4) and $\left(1, 3\frac{2}{3}\right)$

b) Basic graph $y = 3^x$, reflected in *x*-axis, shifted up 1, asymptote $y = 1$, with domain (-∞,∞) and range (-∞,1). Points (0,0) and (1, -2)

c) Basic graph $y = \sqrt{x}$, shifted left 300, reflected in the *x*-axis, and shifted up 500, with domain [-300, ∞), range (-∞,500]. Points (-300,500) and (-299, 499)

d) Basic graph $y = \log_2 x$, shifted left 4, and up 3, asymptote *x* = -4 domain (-4,∞) and range (-∞,∞). Points (-3,3) and (-2, 4)

e) Basic graph $y = e^x$, reflected in *x*-axis, shifted right 4, shifted down 2, horizontal asymptote $y = 2$, with domain (-∞,∞) and range (-∞,2) . Points (4,-3) and $(5, -e-2)$

5. (Section 1.7) $y = \sqrt{x}$; $y = \sqrt{-x}$; $y = -\sqrt{-x}$; $y = -\sqrt{-x} + 2$

6. (Section 1.7) $y = \sqrt{x}$; $y = -\sqrt{x}$; $y = -\sqrt{x+100}$; $y = -\sqrt{x+100} + 200$

7. Shifted right 3, reflected in *x*-axis, up 5 **8.** Shifted left 7, stretched vertically by factor of 2, down 14

9. (Sections 1.2, 4.3) *a*) (-∞,-2) ∪ (-2,9) ∪ (9, ∞) *b*) *All* $x \le \frac{3}{8}$ *c*) *All reals.* *d*) *All reals.* *e*) *All x < 7.* *f*) *All x>-8*

10. (Sections 1.2, 1.6) *a*) 9 *b*) $(x^2-1)\sqrt{x-2}$ or $x^2\sqrt{x-2} - \sqrt{x-2}$ *c*) $|x-2|-1$ *d*) $\sqrt{a-2}$ *e*) $\sqrt{x-2}+3$

f) $\sqrt{x+1}$ *g*) x^2-1 *h*) $-x^2+1$ *i*) $x^2+2xh+h^2-1$ j) $\frac{\sqrt{x-2}}{x^2-1}$ *for* $x \ge 2$ *k*) $\sqrt{x^2-3}$

11. (Section 1.6) *a*)3 *b*) $2x+1+h$ **12**. (Section 2.4) minimum, $(1,-2)$

13. *a – d, f – h, j, k.* Polynomial graphs are covered in Section 3.2 while rational equation graphs are in Section 3.5.

13. *e, i, l, o*. The conic section graphs, the parabola, ellipse and hyperbola are covered in Sections 6.1 – 6.3.

13. *m, n.* Piecewise continuous graphs are covered in Section 1.5.

14. (Sections 3.2) *a*) $\left(0, -2a^3b^2\right)$. *b*) The graph crosses the axis at the *x*-intercept $(-a, 0)$; the graph touches the axis at the *x*-intercept $(b, 0)$. *c*) As $x \to \infty, y \to$ -∞. *d*) As $x \to \infty, y \to \infty$.

15. (Section 3.3 – 3.4) $f(x) = (x-2)^2(x+1)(x+2)$ **16**. (Section 3.3 – 3.4) $x = -5$; $x = -4 \pm i$

17. (Section 4.1) *a*) $g^{-1}(x) = -\frac{1}{3}x + \frac{4}{3}$; domain and range $g =$ domain and range $g^{-1} =$ (-∞,∞)

b) $f^{-1}(x) = \frac{6}{x} - 1$ *or* $f^{-1}(x) = \frac{6-x}{x}$; domain $f =$ range $f^{-1} =$ (-∞,-1) ∪ (-1, ∞);

range $f =$ domain $f^{-1} =$ (-∞,0) ∪ (0, ∞);

c) $y = \sqrt[5]{x+2}$; the domain and range of $y = x^5 - 2$ and domain and range of $y = \sqrt[5]{x+2}$ are (-∞,∞).

d) $f^{-1}(x) = \frac{3x}{x-2}$; domain $f =$ range $f^{-1} =$ (-∞,3) ∪ (3, ∞);

range $f =$ domain $f^{-1} =$ (-∞,2) ∪ (2, ∞)

e) $y = x^3 - 5$; the domain and range of $y = \sqrt[3]{x+5}$ and domain and range of $y = x^3 - 5$ are (-∞,∞).

18. (Section 4.3) $\log_4 y = 3x + 5$ **19**. (Section 4.3) $2^m = p + 3$

20. (Section 4.4) *a*) $\ln\left[\frac{(x+2)^3\sqrt{x}}{x-1}\right]$ *b*) (Section 4.4) $3\log_4 x + \frac{1}{2}\log_4(x-5)$

21. (Section 4.5) *a*) $x = 247$ *b*) $d = \frac{\ln(1/5)}{-0.24} \approx 6.706$ *c*) $x = 3$ **21**. *d*) $x = 4$ ($x = -1$ is extraneous) *e*) $x = \frac{5\ln 2}{3\ln 2 - \ln 6} \approx 12.047$ *f*) $x = \frac{\ln 8}{\ln 3} \approx 1.985$ *g*) $x = -\frac{31}{8}$ *h*) $x = \ln 9 + 4 \approx 6.197$ *i*) $x = \frac{2}{5}$

22. (Section 2.4) Need to do *b* first: *b*) $t = -\frac{96}{2(-16)} = 3$ sec *a*) $h(3) = 96(3) - 16(3)^2 = 144$ units *c*) $t = 6$ sec.

23. (Section 4.6) *a*) $A(105) = 100e^{-0.0347 \cdot 105} \approx 2.616$ g. *b*) $N(5) = 500e^{0.470 \cdot 5} \approx 5243$ bacteria

24. (Section 4.6) $w(30) = 50e^{-0.004 \cdot 30} \approx 44.346$ w. **25**. (Section 2.4) Letting x be the length of two of the sides, the third side is given by $200 - 2x$ so the area function to maximize is $A(x) = x(200 - 2x)$; 50 m. by 100 m.

26. (Section 2.4) $R(x) = x(-2x + 48)$; 12 tickets; \$24. **27**. (Section 1.3) Letting x be the number of years since 1900, and y be the weight of a newborn, $y = 0.00375x - 0.875$; 6.756 lbs.

28. (Section 1.3) $C = \frac{5}{9}F - \frac{160}{9}$, $2\frac{7}{9} = 2.\overline{7}°\ C$

29. (Section 7.1) a) 20, -48, 112, -256, 576 *b*) 4, -5, 13, -23, 49

30. (Sections 7.2, 7.3) *a*) 399 *b*) $a_n = 10 + (n-1)(-4)$ or $a_n = 14 - 4n$ *c*) $a_{100} = 304$, $S_{100} = 15550$

d) 125,250 *e*) $a_{40} = 2(3)^{39} \approx 8.105 \times 10^{18}$ *f*) 403 *g*) 122 *h*) $S_{50} = \frac{2}{3} \cdot \frac{1-(0.5)^{50}}{1-0.5} \approx 1.3$ *i*) $S_\infty = \frac{4}{3}$

j) $S_\infty = \frac{2.4}{1-0.4} = 4$

31. (Section 3.5) $\frac{P(x)}{Q(x)} = \frac{-5(x-2)(x-3)}{(x-1)(x+4)}$

32. *a*) $f(2) = -3$ *b*) $x = -3, x = 4$ *c*) $(-\infty, 6]$ *d*) $[-3, \infty)$ *e*) $(-\infty, 2) \cup (4, 6)$ *f*) $(2, 4)$ *g*) Relative maximum of 3 at $x = 4$; *h*) Relative minimum of -3 at $x = 2$. *i*) $(-1, 3) \cup (5, \infty)$ *j*) -1, 3 and 5 *k*) -2