

MATH 122A  
 FINAL EXAM STUDY GUIDE ANSWERS  
 (Fall 2016 – Spring 2017)

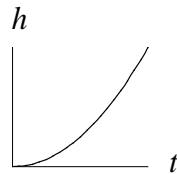
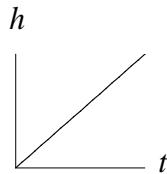
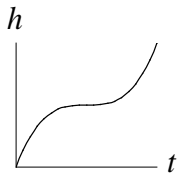
1. a)  $(-\infty, -\sqrt{20}] \cup [\sqrt{20}, \infty)$       b)  $(-\infty, 2) \cup (2, \infty)$       c)  $(-\infty, \infty)$   
 d)  $(-\infty, -4) \cup (-4, \infty)$       e)  $(0, \infty)$

2. a)  $Ax + By = 0$  or  $y = -\frac{A}{B}x$       b)  $y = \frac{B}{A}(x - 2) - 1$

3. a) 90 minutes after leaving Phoenix.      b) 80 miles per hour

c) 
$$D(t) = \begin{cases} (2/3)t & 0 \leq t < 60 \\ (4/3)(t - 60) + 40 & 60 \leq t \leq 120 \end{cases}$$

4. a)      b)      c)



5. a)  $L = kS^2A$   
 b) If the speed of the airplane is only half as much, the area of the wings would need to be four times larger in order for the lift to be the same.

6. We can rewrite our equation as  $R = -pA + (220p - H_0p + H_0)$ . The slope is  $-p$ . A person's target heart rate when exercising drops  $p$  units for each year they get older.

7. a)  $D^3 = kt^2$ ,  $D(t) = \sqrt[3]{kt^2}$   
 b) According to this model, the diameter of a hurricane with duration 140 hours would be approximately 193.5 miles.

8. Account Balance is a function of Week because each week has only one account balance.

9. 
$$\frac{p(t+h) - p(t)}{h} = \frac{-5}{(t+1)(t+h+1)}$$

10. a) The radius of the spill was 4 inches when it was first observed.

b) 
$$A(t) = \pi \left(4 + \sqrt[3]{t/2}\right)^2$$

c) The area of the spill will be  $81\pi$  square inches 250 minutes after the spill is first observed.

d)  $r(16) - r(2) = 1$ . The radius of the oil spill increased by 1 inch between 2 minutes and 16 minutes since the spill was first observed.

11. a) 20

b)  $[0, 5]$

c) No.

d) 15. This is the slope of the line passing through  $(2, g(2))$  and  $(4, g(4))$ .

e)  $x = 3$

f) Concave down.

12. a)  $e^{5t^3}$

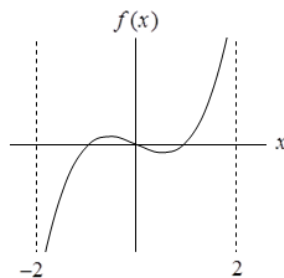
b)  $5t^3 + t$

c)  $\sqrt{t^2 + 1}$

d)  $40t^3 - 1$

13. A: Quadratic  $f(x) = 0.2x^2$     B: Linear  $g(x) = 14x + 3.5$     C: Exponential  $h(x) = 3.5(1.4)^x$

14. One possible graph.



15. 
$$h(x) = \frac{1}{AC}x - \frac{BC + D}{AC}$$
    Slope is  $\frac{1}{AC}$ . Vertical intercept is  $\left(0, -\frac{BC + D}{AC}\right)$

16. The zeros are  $x = -3$  and  $x = 2$ .

17. 
$$f(g(x)) = \frac{3x^2}{4 - x^2}$$

18. a) (2,9)                                      b) (8,-5)                                      c) (-2,-15)

19. a) The annual growth rate is approximately 2.81%. The monthly growth rate is approximately 0.23%.

b) The continuous growth rate per year is approximately 2.77%.

20. a)  $C(t) = 100(0.84)^t$

b) The exact time when 20% of the caffeine has been metabolized is  $t = \frac{\ln(0.8)}{\ln(0.84)}$  hours.

The approximate time is 1.28 hours.

21. a)  $T(t) = 2360 + 70t$ . According to this model, the tuition in 2006 was \$2990 per year.

b)  $T(t) = 2360 \left( \frac{243}{236} \right)^t$ . According to this model, the tuition in 2006 was \$3070.16 per year.

22.  $f(t)$  only

23. a) Domain:  $\left( -\infty, \frac{8}{7} \right)$                                       Range:  $-\infty < y < \infty$

b) Vertical intercept:  $(0, -3)$                                       Horizontal intercept:  $\left( -\frac{8}{7}, 0 \right)$

24. a) There were approximately 1543 fish, three months after introducing the fish.

b)  $P^{-1}(1500) = 0$ . Fifteen hundred fish were initially introduced into the lake system.

c) The population of the fish is increasing.

d) According to the model, the population will reach 1800 fish in  $\frac{\ln 0.4}{-0.03}$  months, or approximately 30.5 months.

e) As  $t \rightarrow \infty$ , the population approaches 2000 fish.

25. a)  $\frac{1}{2} \log_a(x) + \frac{1}{4} \log_a(y) - 5$

b)  $\ln \left( \frac{(x+1)(x^2+1)^{2/3}}{x^3} \right)$

26. a) Point A : (1,0) Point B :  $(e^3, 3)$

$$b) y = \left(\frac{3}{e^3 - 1}\right)x - \frac{3}{e^3 - 1}$$

27. a)  $g(f(x)) = \log_3(9^x) = 2x$

b)  $f(g(x)) = 9^{\log_3 x} = x^2$  for  $x > 0$

c)  $f(x)$  has a horizontal asymptote of  $y = 0$  ,  $g(x)$  has a vertical asymptote of  $x = 0$  .

28. a) True      b) False      c) True      d) False      e) True

29. a) Five      b) Negative

c)  $y = -k(x+5)(x+3)x^2(x-4)$  where  $k > 0$  .

30.  $C(d) = 74\sqrt{250^2 + d^2} + 48(800 - d)$  where  $0 \leq d \leq 800$  .

31.  $P(r) = \pi r + \frac{100 - \pi r^2}{2r} + 2r$

32.  $A(b) = \frac{\sqrt{3}}{2}b^2$

33. y- intercept:  $\left(0, -\frac{1}{5}\right)$       x- intercept:  $\left(\frac{1}{3}, 0\right)$

Vertical asymptote:  $x = \frac{5}{4}$       Horizontal asymptote:  $y = -\frac{3}{4}$

Hole:  $\left(-5, -\frac{16}{25}\right)$

34. a)  $k = 18$       b)  $k = -18$       c)  $k > 0$

35.  $A = 115$        $B = 25$        $C = 160\pi$

36. The height of the Seafirst Tower is approximately 366.29 feet.

$$37. \tan(\theta) = \frac{x}{\sqrt{9-x^2}}$$

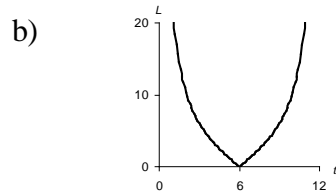
$$38. f\left(g\left(\frac{3\pi}{2}\right)\right) = \frac{\sqrt{2}}{2}.$$

$$39. \frac{\sqrt{x^2-9}}{x} = \sin \theta$$

40. a) C      b) B

$$41. \text{ a) } 0 < A < 1 \quad \text{ b) } \sin^3 \theta = A^3 \quad \cot \theta = -\frac{\sqrt{1-A^2}}{A}$$

42. a) The shadow at 8:00 am is  $6\sqrt{3}$  feet long. There is no shadow at noon.  
The shadow at 2:00 pm is  $\frac{6}{\sqrt{3}}$  feet long.



c) The length of the shadow equals the man's height when  $t \approx 3$  and  $t \approx 9$ . These times correspond to 9:00 am and 3:00 pm.

$$43. \text{ a) } y = 3(2.5)^x \quad \text{ b) } y = -8\cos(4\pi x) \quad \text{ c) } y = \frac{1}{(x+3)^2} - 1$$

$$44. \text{ a) } t = 0, t = \pi, t = 2\pi \quad \text{ b) } x = \pi \quad \text{ c) } \alpha = \frac{\pi}{4}, \alpha = \frac{7\pi}{12}, \alpha = \frac{11\pi}{12}$$

$$45. \text{ a) } -\frac{\pi}{6} \quad \text{ b) } \text{Not defined} \quad \text{ c) } \frac{3}{4} \quad \text{ d) } \frac{3\pi}{4} \quad \text{ e) } \frac{20}{21}$$

46. a)  $f(0) = 3$       b)  $x = \frac{12}{5}$       c)  $f(x)$  has a jump (break) at  $x = 2$ .

47.  $C = \frac{5}{2}$

48. a)  $g(\theta)$  is continuous on the interval.      b)  $f(x)$  is not continuous on the interval.

49. a)  $-\frac{14}{3}$       b)  $\frac{5}{7}$

50. a) -2      b) 2      c) 1      d) -1.5

51. a) 25      b)  $\frac{1}{32}$       c)  $\cos(2)$

52. a)  $\frac{1}{2}$       b)  $\frac{1}{1+e}$       c) 0      d) 1      e) Does not exist

53. B

454. a)  $3z^2(1-6z)^4(1-16z)$       b)  $(e^x + 3)^2$

55. a)  $\frac{5}{b}$       b)  $-\frac{2+m}{3}$       c)  $\ln 5 + y$       d)  $x^5$       e)  $\frac{2y+8}{(y+2)^{3/2}}$

56. a)  $u = \frac{1-\ln 3}{4\ln 3+2}$       b)  $p = \sqrt{77}, p = -\sqrt{77}$       c)  $x = -\frac{1}{5}, x = 2$

d)  $t = 0, t = \frac{7}{3}$       e)  $h_2 = \frac{2A-bh_1}{b}$       f)  $w = 7$

g)  $x = \frac{5y-4}{3-2y}$       h)  $0 \leq z \leq 5$