MAT 151 Final Exam

May 8, 2020

1. [1L] Let $f(x) = 2x - 6$. Solve the equation $f(x) = 4$.

2. [2L] Find the slope of the linear function $f(x)$ whose values are given in the following table.

x	0	2	4
$f(x)$	5	6	7

3. [3L] Find the algebraic equation of the function $f(x)$ in the last question.

4. [4Q] Find all the solutions of $x^2 - 3x - 6 = 0$. (You can round your answer in two decimal places.)

Use Figure 1 to complete the next question.

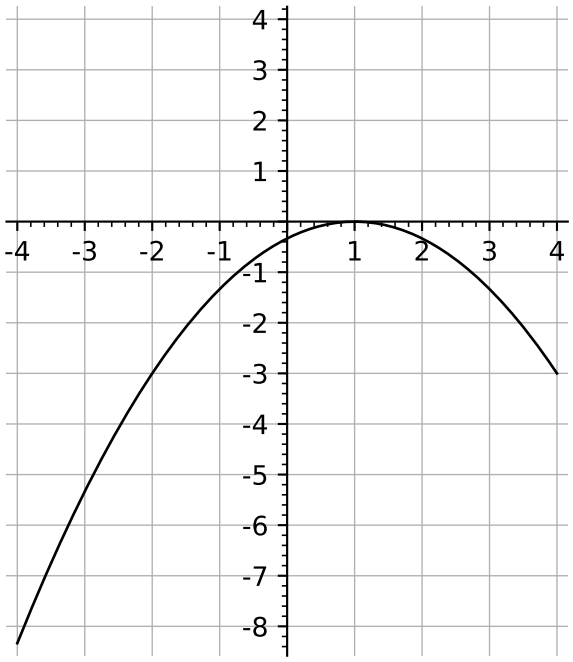


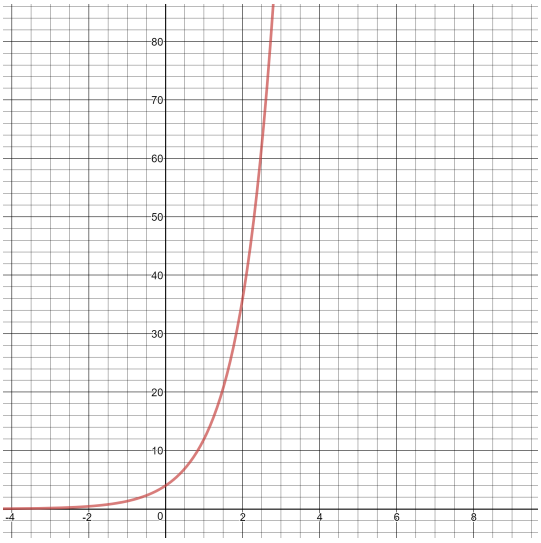
Figure 1: Graph for $v(x)$

5. [5Q] Write an equation for the function $v(x)$.

6. [6Q] Recall that the equation $h(t) = -16t^2 + vt + c$ describes the free-fall of any object experiencing the force of gravity, where $h(t)$ is the height in feet, c is the initial height of the object, and v is the initial velocity of the object. Suppose that a ball is launched vertically into the air from the height 40 ft with velocity 150 ft per second upward. After how many seconds, the ball reaches its maximal height? What is the maximal height that the ball can reach?

7. [7E] Solve $2^{3x} = 4096$.

8. [8E] Based on the graph below, find the algebraic expression of a function of expoential type.



9. 9E The population of mosquitoes on a small island increases during the wet season. The population was measured once per week, as shown in the next table where t is time (in weeks) and $S(t)$ is the amount of mosquitoes.

t	0	2	4
$S(t)$	300	4800	76800

Write a function equation of $S(t)$.

10. 10E Solve the equation $3 + 2\log_5 x = 7$.

11. 11E Write the following expression involving two log functions into one log function

$$2\ln(x-1) - \frac{1}{3}\ln(y+1).$$

12. 12E Fill in the blank

$$\log_2(3) \times \log_3(5) = \log_{(\quad)}(\quad)$$

13. 13F A function $h(x)$ is defined by the following table

x	1	-1	0	2
$h(x)$	2	0	1	-1

For which x so that $h(x) = -1$?

14. 16F Let $f(x) = x^3$ and $g(x) = \sqrt{x}$. Let $h(x) = f(g(x))$. Find $h(4)$.

15. [15F] Let $f(x) = e^x$ and $g(x) = \sqrt{x}$. Let $h(x) = f(x) + (g(x))^2$. Find $h(2)$.

16. [17F] Find the algebraic equation of the inverse function of $g(x) = \sqrt{x-1}$.

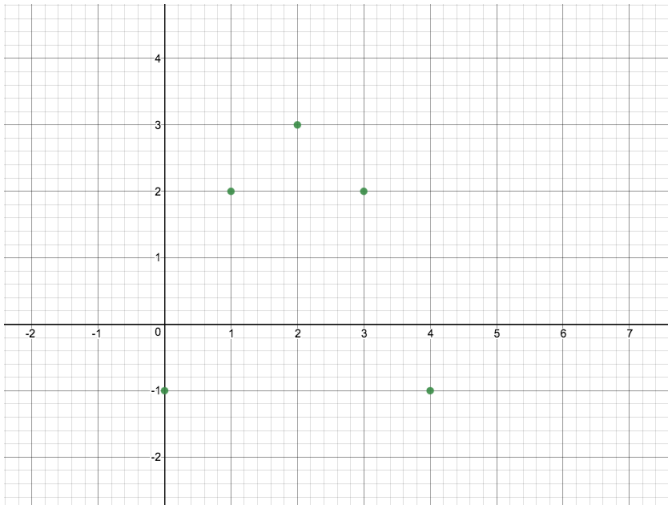
17. [20F] Solve the inequality $(x-2)^2 \leq 9$.

18. [23F] Let $f(x) = x^2$ and $g(x) = 2x^2 - 1$. Describe how to change the graph of $f(x)$ to get the graph of $g(x)$.

19. [27T] Find one possible value of α in the second quadrant so that $\sin(\alpha) = \frac{\sqrt{3}}{2}$. Express your answer in radian.

20. [26T] Write the algebraic equation of the circle centered at $(2, 3)$ with radius 4.

The following graph contains five points.



21. [22F] What type of function best fit these five points?

Let $F(x) = \frac{(x+2)(x-3)}{(x-1)(x+4)}$.

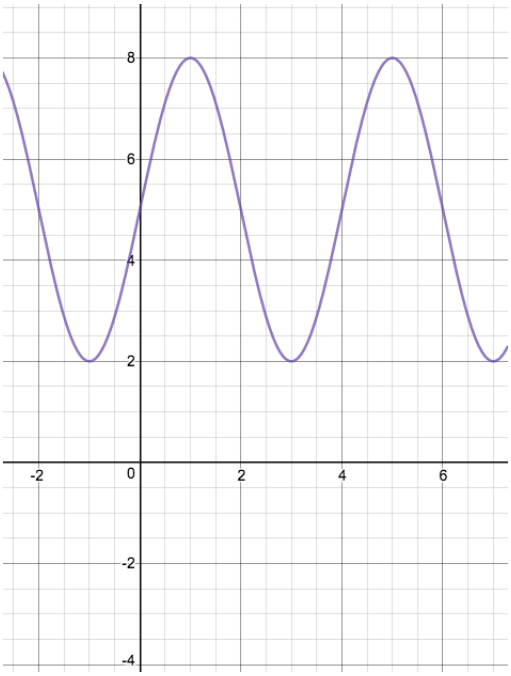
22. [14F] What is the domain of $F(x)$.

23. [19F] Identify the vertical asymptote of $F(x)$.

24. 18F What is the average rate change of the function $F(x)$ between $3 \leq x \leq 6$.

25. 21F Write down *all* the intervals that the function $F(x)$ is increasing.

26. 28T The following is a graph of a trig function $r(\theta)$



Find an algebraic equation of $r(\theta)$ in the form of $a\sin(b(x-h))+k$.

27. [28T] Use the same graph as in the last problem. Find an algebraic equation of $r(\theta)$ in the form of $a\cos(b(x-h))+k$.

28. [25T] What is the distance traveled along the arc of a circle of radius 5 by a point as it moves from 11 o'clock to 4 o'clock clockwisely.

29. [25T] In the last problem, the arc and the two radii (radii is the plural form of radius) enclosed a sector of the circle. What is the area of this sector?

30. [30T] Show that

$$\cos(x) - \frac{\cos(x)}{1 - \tan(x)} = \frac{\sin(x)\cos(x)}{\sin(x) - \cos(x)}.$$

31. [24T] Convert the angle 75° into radian. Keep your answer exact. Don't round π.

32. [29T] Simplify $\sec(\arcsin(-3/4))$.

33. 30T Show that

$$\tan^2(x)\sin^2(x) = \tan^2(x) - \sin^2(x)$$

34. 29T Simplify $\cot(\arccos(-2/5))$.