

review #1

MATH 131

By: Greg Klein

1. If $h(t) = -16t^2 + 100t + 6$ is the height of a ball thrown upwards at $100 \frac{ft}{s}$, then answer the following.

- Find the change in height from 2 seconds to 4 seconds.
- Find the average rate of change of height with respect to time from 2 seconds to 4 seconds.
- Find the average velocity from $t=1$ to $t=4$.
- What is the initial height for the ball?

2. The position of a car is given in the table.

t(sec)	0	5	10	15	20	25	30
s(t) (ft)	0	30	55	105	180	260	410

- Find the average velocity of the car between $t=0$ and $t=15$ and between $t=17$ and $t=27$.
- Find a function that fits the information best.

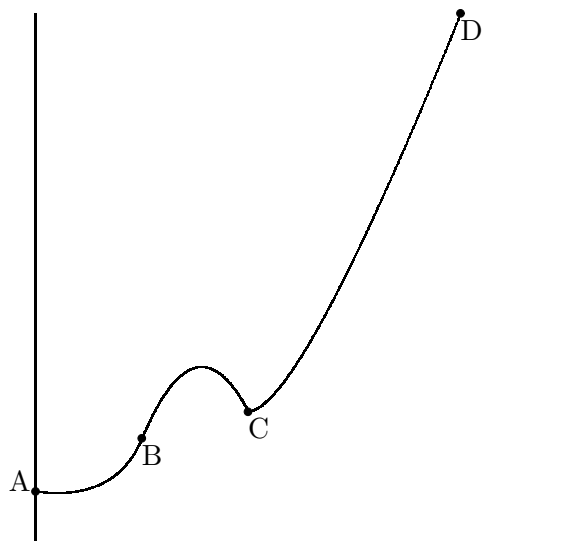
3. Find the equation of the line through (2,5) and (6,-3)

4. Find the equation of the line with horizontal-intercept of 2 and vertical-intercept of -4.

5. Given the data in the table. Find r as a linear function of s and s as a linear function of r .

r	1	3	5	7
s	950	900	850	800

6. The graph of the function $f(t)$ is given.



- Between which two points is the average rate of change greatest?
- Between which two points is the average rate of change smallest?

7. A car rental company offers cars at \$40 per day and 15 cents per mile. Its competitors prices are \$30 per day and 20 cents per mile.

- Write formulas for each company giving the cost of renting a car for one day.
- Write formulas for each company giving the cost of renting a car that is driven 50 miles per day.
- How would you determine which company you should rent from?

8. Write a formula for this statement, "The distance is inversely proportional to the square root of the force between two bodies".

9. Assuming that stopping distance is proportional to the square of the velocity, find the stopping distances for a car going 40 mph and 150 mph if the stopping distance at 70 mph is 170 ft.

10. The table shows data for the average mile per gallon for US automobiles. Graph the data and from the shape decide what type of function it should be. Describe the shape of the graph in terms of concavity and slope.

Year	1940	1950	1960	1970	1980	1986
mpg	14.8	13.9	13.4	13.5	15.5	18.3

11. If a population of clams is growing at 1% per year, and there are 1 million tons of clams now, how many tons of clams will there be in 6 years? What is the doubling time for the tons of clams?

12. A substance evaporates exponentially in a closed container, if there is 3 grams at the end of day 1 and 2 grams at the end of day 6, find an equation that give the amount as a function of time. How much material was originally placed in the container? What is the half-life for the material.

13. The red ant mound has 40 thousand ants and grows at 3% per year, the black ant mound has 30 thousand ants and grows at 3.5% per year.

- (a) When will the ants have the same population?
- (b) When will the black ants have twice as many ants as the red ants?
- (c) If each colony started with one ant, when did each one start?

14. What annual rate will give the same amount as the continuous rate of 5%?

15. Where is $e^{-0.5x^2}$ increasing, decreasing, concave up, concave down?

16. Your parents have started a bank account for you with \$6,000.

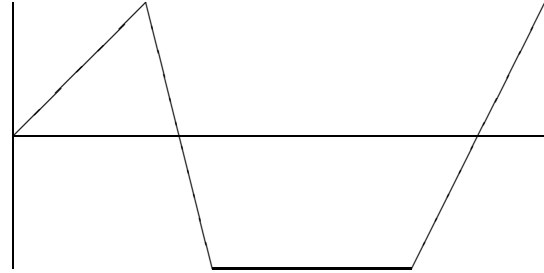
- (a) If this account earns 8% compounded continuously, how much is in it after 1 year?
- (b) At the end of three years, you make a one-time withdrawal of \$1000. Find the times where the balance of the account was \$7000. Give answers from the start of the account.

17. If a radioactive substance has a half life of 10 years, how much is left after 5 years?

18. For the data below determine what type of function each could be and why?

	f(x)	g(x)	h(x)
1	.94	.96	1
3	.85	.88	.74
5	.76	.80	.64
7	.68	.73	.59
9	.61	.65	.55
11	.55	.57	.52
13	.5	.5	.5

19. The graph is $f(x)$. Sketch the graphs of $f(x) + 2$, $f(x + 2)$, $2f(x)$, $\frac{1}{f(x)}$.



20. Let $f(t) = t^2$, $g(t) = 4te^t$. Find:

- (a) $f(g(x))$
- (b) $g(f(s))$
- (c) $g(g(x))$

21. A polynomial crosses the horizontal axis 4 times what is the smallest degree it can have?

22. If a polynomial touches the horizontal axis twice, but does not cross what is the smallest degree it can have?

23. Find a polynomial that crosses the horizontal axis at -1, 2, and 3.

24. To the previous problem add the point (0,4).

25. What is the amplitude and period for $\sin(2t)$, $6\cos(2t + 4)$?

26. The high and low tides differ by 5 feet at a certain pier. The midtide mark is 12 feet from the bottom of the pier. If high tide is at midnight and low tide 12 hours later, find a function of depth of the water with respect to time in hours since hightide.

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- 8 ft
 - $\frac{150-142}{4-2} = 4ft/sec$
 - $\frac{150-90}{4-1} = 20ft/sec$
 - 6 ft
- $\frac{105-0}{15-0} = 7ft/sec$,
 $\frac{324.38-128.79}{27-17} = 19.56ft/sec$
used the regression function to compute position at $t=17$ and $t=27$.
 - Quadratic
- $y - 5 = \frac{-3-5}{6-2}(x - 2)$
- $y - 0 = \frac{-4-0}{0-2}(x - 2)$
- $r(s) = -25s + 975, s(r) = -0.04r + 39$
- CD
 - BC
- $r1(m) = 40 + 0.15m$,
 $r2(m) = 30 + 0.20m$
 - $r1(d) = 40d + 0.15 * 50$,
 $r2(d) = 30d + 0.20 * 50$
 - Answers vary.
- $D(F) = \frac{k}{\sqrt{F}}$
- $d(40) = 55.5$ feet, $d(150) = 780.8$ feet
- concave up everywhere, decreasing to about 1965, increasing thereafter.
- Tons of clams in 6 years 1.0615 tons, 69.66 years
- originally 3.2534 grams, half-life is 8.54 days
- about 59 years
 - about 202 years
 - red ants 358 years ago, black ants 304 years ago
- 5.127 %
- increasing $(-\infty, 0)$, decreasing $(0, \infty)$, concave up $(-\infty, -1), (1, \infty)$, concave down $(-1, 1)$
- \$6499.72
 - The first time the account reaches \$7000 is 1.927 years after the account was started. The second time the account reaches \$7000 is 3.683 years after the account was started.
- 70.7 %
- $g(x)$ is linear, $f(x)$ is quadratic or exponential, $h(x)$ is a power function
- $f(x)+2$ is a shift up 2, $f(x+2)$ shifts 2 left, $2f(x)$ stretches vertically by 2, $\frac{1}{f(x)}$ does strange things. I'll go over it in week in review.
- $f(g(x)) = (4xe^x)^2$
 - $g(f(s)) = 4s^2e^{s^2}$
 - $g(g(x)) = 4(4xe^x)e^{4xe^x}$
- degree 4
- degree 4
- $f(x) = (x + 1)(x - 2)(x - 3)$
- $f(x) = \frac{4}{6}(x + 1)(x - 2)(x - 3)$
- $\sin(2t)$ amplitude 1, period π , $6 \cos(2t + 4)$ amplitude 6, period π
- $2.5 \sin(\frac{2\pi}{12}(t + 6)) + 12 = 2.5 \cos(\frac{2\pi}{12}t) + 12$