

1. The table shows the population of a small town in increments of twenty years.

| Year       | 1880 | 1900 | 1920 | 1940 | 1960 | 1980 | 2000 |
|------------|------|------|------|------|------|------|------|
| Population | 118  | 188  | 273  | 415  | 590  | 868  | 1252 |

- (a) Find the change in the population between 1900 and 1940.
- (b) Find the average rate of change in the population from 1880 to 1940.
- (c) Estimate the instantaneous rate of change of the population in 1940.

2. Classify each function as linear, exponential, or neither

| x    | 1 | 2 | 3 | 4  | 5  | 6  |
|------|---|---|---|----|----|----|
| f(x) | 2 | 4 | 6 | 8  | 10 | 12 |
| g(x) | 2 | 4 | 8 | 16 | 32 | 64 |
| h(x) | 2 | 4 | 6 | 10 | 16 | 26 |

3.  $f(x)$  is given by the formula  $f(x) = 3x^2 + 1$ .

(a) Find  $f(2)$ .

(b) Find  $f(2 + h)$ .

(c) Find  $\frac{f(2 + h) - f(2)}{h}$ .

4. The radioactive isotope carbon-14 was discovered in 1940. If we had a 10 gram sample of carbon-14 in 1940 the amount of carbon-14 remaining  $t$  years after 1940 would be given by the formula  $C(t) = 10 \cdot 2^{-t/5730}$ .
- (a) Find the amount of carbon-14 that would remain in 2009.
  
  
  
  
  
  
  
  
  
  
  - (b) Use any method to estimate the instantaneous rate of change in the amount of carbon-14 in 2009.
  
  
  
  
  
  
  
  
  
  
  - (c) What is the half-life of carbon-14?
5. An investment of \$3000 is made in an account paying 5% interest compounded yearly.
- (a) Find a formula for the future value of the investment in  $t$  years.
  
  
  
  
  
  
  
  
  
  
  - (b) In what year will the future value of the investment be \$20,000?
6. The pressure in the ocean is directly proportional to the depth. The pressure at a depth of 30 feet is 14.7 PSI.
- (a) Find a formula that relates pressure and depth.
  
  
  
  
  
  
  
  
  
  
  - (b) The pressure generated by a salvage yard car-crusher is around 3,000 PSI. At what depth would this pressure occur?

7. Find the derivative of  $\tan(x)$ . hint:  $\tan(x) = \frac{\sin(x)}{\cos(x)}$

8. Find the derivative of  $x \ln(x)$ .

9. Find the derivative of  $2^{x^3}$ .

10. Let  $f(x)$  be given by the formula  $f(x) = 2x^3 + 3x^2$ .

(a) Find the derivative of  $f(x)$ .

(b) What are the critical points for  $f(x)$ ?

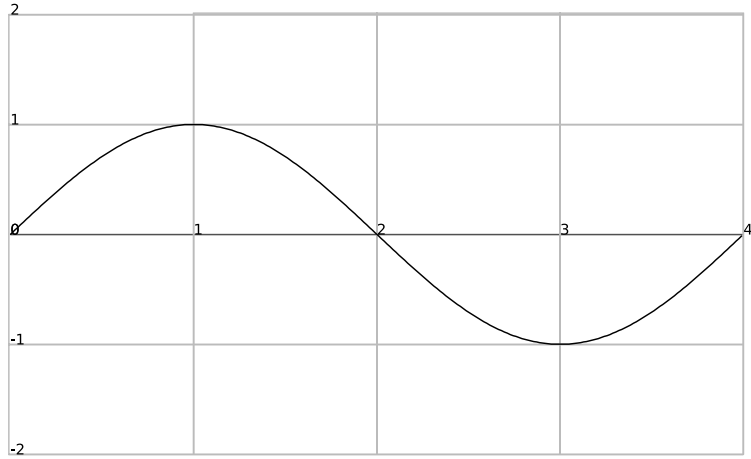
(c) Where are the local minima and maxima of  $f(x)$ ?

11. Estimate  $\int_5^9 1 + x^2 dx$ .

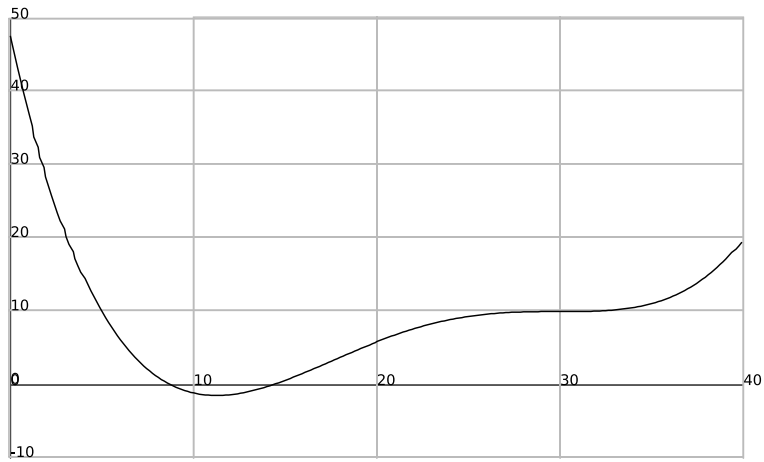
12. Write a left hand sum approximating the distance travelled in 20 seconds using the table below.

|                    |   |    |    |    |    |
|--------------------|---|----|----|----|----|
| time (seconds)     | 0 | 5  | 10 | 15 | 20 |
| speed (meters/sec) | 0 | 10 | 15 | 30 | 60 |

13. Find the area between the graphs of  $f(x) = x^2$  and  $g(x) = 2 + x$  over the interval  $(0, 2)$ .



14. sketch a graph of the derivative of the function graphed above.



15. (a) For which intervals is the graph concave up?

(b) What are the x coordinates of the inflection points?

16. Find the equation of the tangent line to the graph of  $f(x) = x^3 + x$  at  $x = 0$

17. The marginal cost for a company to produce  $q$  units is given by  $C'(q) = 1/x$ . What increase in cost should the company expect if production is to be increased from 50 to 100 units?