

Local Linearity/ Tangent Line Approximation

Use the following table to answer #13 to #16.

Year	1960	1970	1980	1990
Population (millions)	31.4	38.6	50.2	76.0

1. What is the practical meaning of $\left. \frac{dP}{dt} \right|_{t=1980}$? 2. Estimate $\left. \frac{dP}{dt} \right|_{t=1980}$.

3. Estimate the population in 1982.

Use the following table to answer #4 to #7.

t	0	.2	.4	.6	.8	1.0
$f(t)$	2.7	2.4	2.3	2.3	2.8	3.2

4. Estimate $f'(.85)$. 5. Estimate $f(.85)$.

6. Find the equation of the tangent line at $t = .85$. 7. Use your equation in #6 and find y at $x = .85$. Compare this answer with #5.
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8. Find the equation of the line tangent to $f(x) = \frac{1}{x^2}$ at $(-2, \frac{1}{4})$. Hint: Use the short-cut to find the derivative.
- (A) $4x + y = -3$
 - (B) $4x - 4y = 3$
 - (C) $4x - y = 3$
 - (D) $4x - 4y = -3$
 - (E) $x - 4y = -3$

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9. Find the equation of the line tangent to $x = y^2 + 1$ at $x = 1$.
- (A) $x = 1$
 - (B) $x = 0$
 - (C) $y = 1$
 - (D) $y = 0$
 - (E) No such line exists.

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10. Let f be the function defined by $f(x) = 4x^3 - 5x + 3$. Which of the following is an equation of the line tangent to the graph of f at the point where $x = -1$?
- (A) $y = 7x - 3$ (B) $y = 7x + 7$ (C) $y = 7x + 11$ (D) $y = -5x - 1$ (E) $y = -5x - 5$
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11. Let $f(x)$ be the tangent line for a function $g(x)$ at $x = 1$ and suppose $f(1) = 7$ and $f(-2) = -5$. Using this tangent line, $g(1.2)$ is

(A) 7.0

(B) 7.4

(C) 7.8

(D) 8.0

(E) 8.2

12. Let f be a function with $f(1) = -4$ such that for all point (x, y) on the graph of f the slope is given by $\frac{3x^2 + 1}{2y}$.

(a) Find slope of the graph of f at the point where $x = 1$.

(b) Write an equation for the line tangent to the graph of f at $x = 1$ and use it to approximate $f(1.2)$.

13. Let h be a function defined for all $x \neq 0$ such that $h(4) = -3$ and the derivative of h is given by

$$h'(x) = \frac{x^2 - 2}{x} \text{ for all } x \neq 0.$$

(a) Find all values of x for which the graph of h has a horizontal tangent.

(b) Write an equation for the line tangent to the graph of h at $x = 4$.

ANSWERS:

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| 1) change in pop per yr in 1980 | 6) $y = 2x + 1.2$ | 11) C |
| 2) 1.87 mil/yr | 7) 2.9 | 12a) -0.5 |
| 3) 53.94 or 55.36mil | 8) E | b) $y = -0.5x - 3.5$; $f(1.2) = -4.1$ |
| 4) 2 | 9) A | 13a) $\pm\sqrt{2}$ |
| 5) 2.9 | 10) C | b) $y + 3 = (7/2)(x - 4)$ |