Math 124: Advanced Practice with Derivatives from Graphs & Tables

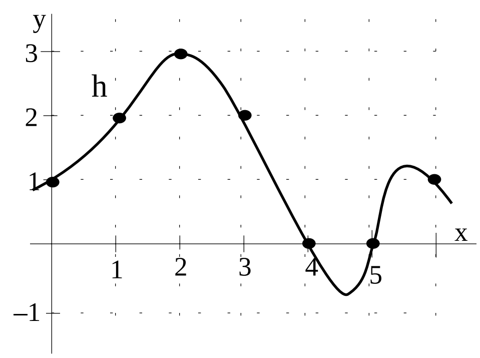
Use the information in the formula, table and graph to evaluate the derivatives below.

$f(x) = x^2 - 3x + 1$

$f'(x) = 2x - 3$

SOME SOLUTIONS

x	g(x)	g '(x)
0	3	–1
1	2	0
2	4	2
3	1	–3
4	0	3
5	4	–1
6	5	1
7	2	0



$h'(0)=1/2$, $h'(3)=h'(4)= -2$, $h'(5)=3$, $h'(6)=-1$

1. at $x = 1$, $\mathbf{D(}\ g(3x-1)\ \mathbf{)} = g'(3x-1)\cdot\mathbf{D(}\ 3x-1\ \mathbf{)} = g'(3x-1)\cdot 3 = g'(\ 3(1)-1\ )\cdot 3 = g'(\ 2\ )\cdot 3 = (2)(3) = 6$

2. at $x = 3$, $\mathbf{D(}\ g(\ x^2 - 5\ )\ \mathbf{)} = g'(\ x^2 - 5\ )\cdot\mathbf{D(}\ x^2 - 5\ \mathbf{)} = g'(\ x^2 - 5\ )\cdot(\ 2x\ ) = g'(\ 9-5\ )\cdot(\ 2\cdot 3\ ) = (3)(6) = 18$

3. at $x = 3$, $\mathbf{D(}\ g(10 - 2x)\ \mathbf{)} = g'(10-2x)\cdot\mathbf{D(}\ 10-2x\ \mathbf{)} = g'(10-2x)\cdot(-2) = g'(\ 4\ )\cdot(-2) = (3)\cdot(-2) = -6$

4. at $x = 2$, $\mathbf{D(}\ g^3(\ x\ )\ \mathbf{)} = 3\cdot g^2(\ x\ )\cdot g'(\ x\ ) = 3\cdot g^2(\ 2\ )\cdot g'(\ 2\ ) = 3\cdot(\ 4\ )^2\ \cdot(\ 2\ ) = 96$

5. at $x = 1$, $\mathbf{D(}\ g^2(\ x\ )\ \mathbf{)} = 2g^{2-1}(x)\cdot\ g'(x) = 2g(x)\cdot\ g'(x) = 2g(\ 1\ )\cdot\ g'(1) = 2(\ 2\ )(\ 0\ ) = 0$

6. at $x = 3$, $\mathbf{D(}\ g(\ f(x)\ )\ \mathbf{)} = g'(\ f(x)\ )\cdot f'(x) = g'(\ f(3)\ )\cdot f'(3) = g'(\ 3^2 - 3\cdot 3 + 1\ )\ (\ 2\cdot 3 - 3\ ) = g'(1)\cdot(3) = (0)\cdot(3) = 0$

7. at $x = 2$, $\mathbf{D(}\ g(\ h(x)\ )\ \mathbf{)} = g'(\ h(x)\ )\cdot h'(\ x\ ) = g'(\ h(2)\ )\cdot h'(\ 2\ ) = g'(\ 3\ )\cdot h'(\ 2\ ) = (-3)(\ 0\ ) = 0$

9. at $x = 4$, $\mathbf{D(}\ h(\ g(x)\ )\ \mathbf{)} = h'(\ g(x)\ )\cdot g'(\ x\ ) = h'(\ g(4)\ )\cdot g'(\ 4\ ) = h'(\ 0\ )\cdot g'(\ 4\ ) = (1/2)(\ 3\ ) = 3/2$

11. at $x = 3$, $\mathbf{D(}\ g(\ x + h(x)\ )\ \mathbf{)} = g'(\ x + h(x)\ )\cdot\mathbf{D(}\ x + h(x)\ \mathbf{)} = g'(\ x+h(x)\ )\cdot(\ 1 + h'(x)\ )$

$= g'(3+h(3))\cdot(1 + h'(3)\ ) = g'(3+2)\cdot(1 - 2) = (-1)\cdot(-1) = 1$

13. at $x = 2$, $\mathbf{D(}\ f(\ g(x)\ )\ \mathbf{)} = f'(\ g(x)\ )\cdot g'(\ x\ ) = f'(\ g(2)\ )\cdot g'(\ 2\ ) = f'(\ 4\ )\cdot g'(\ 2\ ) = (5)\cdot(\ 2\ ) = 10$

15. at $x = 0$, $\mathbf{D(}\ g(\ x^3 + h(x)\ )\ \mathbf{)} = g'(\ x^3 + h(x)\ )\cdot\mathbf{D(}\ x^3 + h(x)\ \mathbf{)} = g'(\ x^3 + h(x)\ )\cdot(\ 3x^2 + h'(x)\ )$

$= g'(\ 0 + h(0)\ )\cdot(\ 0 + h'(\ 0\ )\ ) = g'(\ 1\ )\cdot(\ 1/2\ ) = (\ 0\ )\cdot(\ 1/2\ ) = 0$

17. at $x = 0$, $\mathbf{D(}\ g(\ \sin(x)\ )\ \mathbf{)} = g'(\ \sin(x)\ )\cdot\mathbf{D(}\ \sin(x)\ \mathbf{)} = g'(\ \sin(x)\ )\ \cdot\cos(x) = g'(\ \sin(0)\ )\cdot\cos(0)$

$= g'(\ 0\ )\cdot 1 = (\ -1\ )\cdot 1 = -1$

18. at $x = 4$, $\mathbf{D(}\ \cos(\ g(x)\ )\ \mathbf{)} = \cos'\ (\ g(x)\ )\cdot g'(x) = -\sin(\ g(x)\ )\cdot g'(x) = -\sin(\ g(4)\ )\cdot g'(4) = -\sin(\ 0\ )\cdot(3) = -(0)(3) = 0$

19. at $x = 5$, $\mathbf{D(}\ \sqrt{g(x)}\ \mathbf{)} = \mathbf{D(}\ (\ g(x)\ )^{1/2}\ \mathbf{)} = \frac{1}{2}(\ g(x)\ )^{-1/2}\ \cdot g'(x) = \frac{1}{2}(\ g(5)\ )^{-1/2}\ \cdot g'(5)$

$= \frac{1}{2}(\ 4\ )^{-1/2}\ \cdot(\ -1\ ) = \frac{1}{2}\ \cdot\ \frac{1}{2}(-1)\ = -\frac{1}{4}$

Answers: 1. 6 2. 18 3. **–6** 4. 96 5. 0 6. **0** 7. 0 8. 2 9. 3/2 10. 2 11. 1
12. 0 13. 10 14. 6 15. **0** 16. 44 17. –1 18. 0 19. –1/4 20. 3