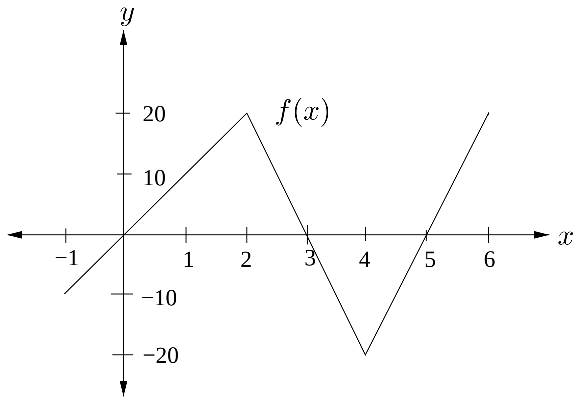
5. (20 points) A graph of $y = f(x)$ and a table of values for $g(x)$ and $g'(x)$ are given below. Use them to solve (a)-(d).



x	$g(x)$	$g'(x)$
0	10	-3
1	-2	4
2	5	20

(a) If $h(x) = 2f(x) + x^5$, find $h'(5)$.

$h'(x) = 2f'(x) + 5x^4$. So evaluating this at 5 and using that $f'(5) = 20$ we have $h'(5) = 40 + 5^5 = 3165$.

(b) If $p(x) = 6f(x)(g(x) + 2)$, then find $p'(1)$.

$p'(x) = 6f'(x)(g(x)+2)+6f(x)g'(x)$ using the product and chain rules. Thus $p'(1) = 6f'(1)(g(1)+2) + 6f(1)g'(1) = 6 \cdot 10 \cdot (-2 + 2) + 6 \cdot 10 \cdot 4 = 240$.

(c) If $r(x) = g(f(x) - 9)$, find $r'(1)$.

$r'(x) = g'(f(x) - 9)f'(x)$ using the chain rule. Thus $r'(1) = g'(f(1) - 9)f'(1) = g'(1)f'(1) = 4 \cdot 10 = 40$.

(d) If $j(x) = g(f(3x)) + \cos(\frac{\pi}{2}x)$, then find $j'(1)$.

$j'(x) = g'(f(3x))f'(3x)3 - \sin(\frac{\pi}{2}x)\frac{\pi}{2}$ by repeated applications of the chain rule. Thus $j'(1) = g'(f(3))f'(3)3 - \frac{\pi}{2}\sin(\frac{\pi}{2}) = -3 \cdot (-20) \cdot 3 - \frac{\pi}{2} = 180 - \frac{\pi}{2}$.