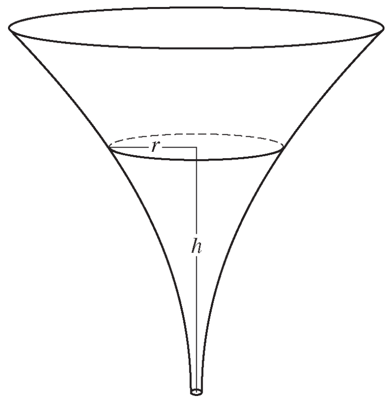
2016 AB/BC 5

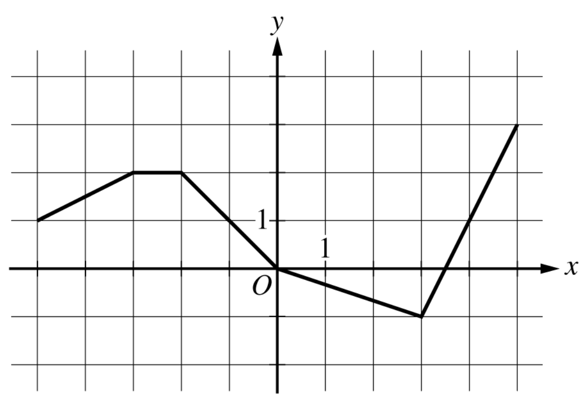


5. The inside of a funnel of height 10 inches has circular cross sections, as shown in the figure above. At height h, the radius of the funnel is given by $r = \frac{1}{20}\left(3 + h^2\right)$, where $0 \le h \le 10$. The units of r and h are inches.

   (c) The funnel contains liquid that is draining from the bottom. At the instant when the height of the liquid is $h = 3$ inches, the radius of the surface of the liquid is decreasing at a rate of $\frac{1}{5}$ inch per second. At this instant, what is the rate of change of the height of the liquid with respect to time?

2017 AB 6

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



Graph of h

6. Let f be the function defined by $f(x) = \cos(2x) + e^{\sin x}$.

   Let g be a differentiable function. The table above gives values of g and its derivative g' at selected values of x. Let h be the function whose graph, consisting of five line segments, is shown in the figure above.

   (a) Find the slope of the line tangent to the graph of f at $x = \pi$.

   (b) Let k be the function defined by $k(x) = h\big(f(x)\big)$. Find $k'(\pi)$.

   (c)Let m be the function defined by $m(x) = g(-2x) \cdot h(x)$. Find $m'(2)$.

AP® CALCULUS AB/CALCULUS BC
2016 SCORING GUIDELINES

Question 5

(c) $\frac{dr}{dt} = \frac{1}{20}(2h)\frac{dh}{dt}$ $-\frac{1}{5} = \frac{3}{10}\frac{dh}{dt}$ $\frac{dh}{dt} = -\frac{1}{5} \cdot \frac{10}{3} = -\frac{2}{3}$ in/se	3 : $\begin{cases} 2 : \text{chain rule} \\ 1 : \text{answer} \end{cases}$

AP® CALCULUS AB
2017 SCORING GUIDELINES

Question 6

(a) $f'(x) = -2\sin(2x) + \cos x\, e^{\sin x}$ $f'(\pi) = -2\sin(2\pi) + \cos \pi\, e^{\sin \pi} = -1$	2 : $f'(\pi)$
(b) $k'(x) = h'(f(x)) \cdot f'(x)$ $k'(\pi) = h'(f(\pi)) \cdot f'(\pi) = h'(2) \cdot (-1)$ $= \left(-\frac{1}{3}\right)(-1) = \frac{1}{3}$	2 : $\begin{cases} 1 : k'(x) \\ 1 : k'(\pi) \end{cases}$
(c) $m'(x) = -2g'(-2x) \cdot h(x) + g(-2x) \cdot h'(x)$ $m'(2) = -2g'(-4) \cdot h(2) + g(-4) \cdot h'(2)$ $= -2(-1)\left(-\frac{2}{3}\right) + 5\left(-\frac{1}{3}\right) = -3$	3 : $\begin{cases} 2 : m'(x) \\ 1 : m'(2) \end{cases}$