

1.  $H(x) = F(F(F(x)))$  where  $F(x)$  is a differentiable function. Suppose that  $F(0) = 1, F(1) = 2, F(2) = 0, F'(0) = 1/2, F'(1) = 1/3, F'(2) = -1/4$ . Then  $H'(0)$  is which of the following?

- (a)  $\frac{-1}{24}$
- (b) 0
- (c)  $\frac{1}{24}$
- (d)  $\frac{-1}{12}$
- (e) 1

2. A certain function  $f$  having continuous derivatives satisfies  $f(0) = 0, f(10) = 0$  and  $f'(0) = -5$ . **TRUE or FALSE?** There is an  $x$  between 0 and 10 for which  $f'(x) = -5$ .

- (a) TRUE
- (b) FALSE

3. The function  $p(x)$  is a 4th degree polynomial with roots 0, 1, 4 and 5. Moreover  $p'(4) = 3$ . Then, regarding  $p'(0)$  we know

- (a) nothing :  $p'(0)$  could be any number
- (b)  $p'(0) = 3$
- (c)  $p'(0) = 5$
- (d) only that  $p'(0) \neq 0$ .
- (e)  $p'(0) = -12$ .

4. (\*) Suppose that  $k > 0$  is a constant. Which assertions hold for  $N(t) = \frac{9e^{kt}}{e^{kt} + 2e^{-kt}}$ ?

- (a)  $\lim_{t \rightarrow +\infty} N(t) = 9$
- (b)  $dN/dt > 0$  for all values of  $t$  is monotone increasing
- (c)  $d^2N/dt^2 > 0$  for all  $t$
- (d) there is exactly one  $t$  with  $N(t) = 8.935$ .
- (e)  $\lim_{t \rightarrow +\infty} N(t) = +\infty$

5.  $\frac{n}{n+1} - \frac{n-1}{n} =$

- (a)  $\frac{-1}{n(n+1)}$
- (b)  $\frac{1}{n(n+1)}$
- (c) none of the above
- (d)  $\frac{-2}{n+1}$
- (e)  $\frac{1}{n^2}$

a

6. TRUE or FALSE?

$$\frac{1}{1 + \frac{2}{\frac{1}{1 + \frac{3}{4}}}} < 1/3$$

- (a) TRUE
- (b) FALSE

7. (\*) a  $[8(x + \frac{1}{x})^2]^{-1/3} = ?$

(a)  $-\frac{1}{3}8(x^{-2/3} + (1/x)^{-2/3})$

(b)  $\frac{1}{2} \frac{1}{x^2+2+(1/x)^2}$

(c)  $\frac{1}{2}(x + \frac{1}{x})^{-2/3}$

(d)  $8^{-2/3}(x^{-2/3} + (1/x)^{-2/3})$

(e)  $8^{-2/3}(x + \frac{1}{x})^{-2/3}$

8. TRUE or FALSE?  $\frac{1}{2}(\frac{1}{2} + \frac{1}{3}) > \frac{2}{5}$

(a) FALSE

(b) TRUE