7. For what value of k will $x+\frac{k}{x}$ have a relative maximum at $x=-2$?

(A) –4 (B) –2 (C) 2 (D) 4 (E) None of these

$y'=0$

$1-\frac{k}{x^2}=0$

$k\left(\frac{1}{x}\right)$

$1-\frac{k}{(-2)^2}=0$ $k=4$ $=k(x^{-1})$

20. An equation for a tangent to the graph of $y = \arcsin\frac{x}{2}$ at the origin is

(A) $x - 2y = 0$ (B) $x - y = 0$ (C) $x = 0$ (D) $y = 0$ (E) $\pi x - 2y = 0$

$\to (0,0)$

$m = f'$

(x, y)

$$y' = \frac{\frac{1}{2}}{\sqrt{1-\left(\frac{x}{2}\right)^2}}$$

$$(\arcsin x)' = \frac{1}{\sqrt{1-x^2}}$$

$x=0 \quad y' = \frac{1}{2}$

$y = \frac{1}{2}x$

$2y = x$

$0 = x - 2y$

28. The function defined by $f(x) = \sqrt{3}\cos x + 3\sin x$ has an amplitude of

(A) $3-\sqrt{3}$ (B) $\sqrt{3}$ (C) $2\sqrt{3}$ (D) $3+\sqrt{3}$ (E) $3\sqrt{3}$

$$f' = -\sqrt{3}\sin x + 3\cos x = 0$$

$$\frac{\sqrt{3}\sin x}{\sqrt{3}\cos x} = \frac{3\cancel{\cos x}}{\sqrt{3}\cancel{\cos x}}$$

$$\tan x = \sqrt{3}$$

$$x = \frac{\pi}{3}, \frac{4\pi}{3}$$

x	f
$\frac{\pi}{3}$	$\sqrt{3}\cos\frac{\pi}{3} + 3\sin\frac{\pi}{3}$ $\frac{\sqrt{3}}{2} + \frac{3\sqrt{3}}{2} = 2\sqrt{3}$
$\frac{4\pi}{3}$	$\sqrt{3}\cos\frac{4\pi}{3} + 3\sin\frac{4\pi}{3}$ $-\frac{\sqrt{3}}{2} - \frac{3\sqrt{3}}{2} = -2\sqrt{3}$

$m_1 = -\frac{1}{m_2}$

34. Which of the following is an equation of a curve that intersects at right angles every curve of the family $y = \frac{1}{x} + k$ (where k takes all real values)?

(A) $y = -x$ (B) $y = -x^2$ (C) $y = -\frac{1}{3}x^3$ (D) $y = \frac{1}{3}x^3$ (E) $y = \ln x$

$y' = -\frac{1}{x^2}$ $f' = x^2$

45. If $\frac{d}{dx}(f(x)) = g(x)$ and $\frac{d}{dx}(g(x)) = f(x^2)$, then $\frac{d^2}{dx^2}\left(f(x^3)\right) =$

(A) $f\left(x^6\right)$

(B) $g\left(x^3\right)$

(C) $3x^2 g\left(x^3\right)$

(D) $9x^4 f\left(x^6\right) + 6x\, g\left(x^3\right)$

(E) $f\left(x^6\right) + g\left(x^3\right)$

$$f'(x^3) = g(x^3) \cdot 3x^2$$

$$f''(x^3) = 6x\, g(x^3) + f(x^6)(3x^2)^2$$

$$= 6x\, g(x^3) + 9x^4 f(x^6)$$

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19. A point moves on the x-axis in such a way that its velocity at time t $(t > 0)$ is given by $v = \frac{\ln t}{t}$. At what value of t does v attain its maximum?

(A) 1 (B) $e^{\frac{1}{2}}$ (C) e (D) $e^{\frac{3}{2}}$

(E) There is no maximum value for v.

$$v' = \frac{t \cdot \frac{1}{t} - 1 \cdot \ln t}{t^2} = \frac{1 - \ln t}{t^2} = 0$$

$+$ $-$

e

$t = 1$

$$\frac{1 - \ln 1}{1^2}$$

$$1 - \ln t = 0$$

$$1 = \ln t$$

$$e = t$$