SOLUTION KEY

PreCalculus
Trigonometric Functions Test v3
Round to 3 decimal places.
CALCULATOR ALLOWED

1. If $g(x)=x^3+\sin x$, then $\lim_{h\to 0}\frac{g(x+h)-g(x)}{h}$ $= g'(x) = 3x^2+\cos x$

(a) $3x+\cos x$
(b) $3x^2-\sin x$
(c) $3x^2+\sin x$
(d) $3x^2+\cos x$
(e) $3x^2+\sin x$

2. What is the slope of the line tangent to the curve $y=\arcsin(4x)$ at the point at which $x=0$?

$\frac{dy}{dx} = \frac{1}{\sqrt{1-(4x)^2}}$ (4)

$m(0) = 4$

(a) 0
(b) $\frac{1}{2}$
(c) 1
(d) 2
(e) 4

3. The first derivative of the function $f(x)$ is defined by $f'(x)=e^x\sin x$ for $0\le x\le 2\pi$. How many critical values does the graph of $f(x)$ have?

(a) None
(b) One
(c) Two
(d) Three
(e) Four

4. The sales of lumber S (in millions of square feet) for the years 1980 to 1990 is modeled by the function $S(t) = 0.46\sin(0.45t + 3.15) + 3.4$ where t is the time in years with $t = 0$ corresponding to the beginning of 1980. Determine the year when the lumber sales were increasing at the greatest rate.

(a) 1983
(b) 1984
(c) 1985
(d) 1986
(e) 1987

$S'(t) = .46\cos(.45t + 3.15) \cdot (.45) = 0$

$S''(t) = -(.46)(.45)(.45)\sin(.45t + 3.15)$

$t = 7$

Free Response (10 pts. each)

1. Find the extreme values of $y = x^2 \sin x$ on $x \in [-2\pi, 2\pi]$.

i) $\frac{dy}{dx} = x^2\cos x + 2x\sin x = 0$

$x = 0, \pm 2.289, \pm 5.047$

ii) never

iii) $x = \pm 2\pi$

$y(0) = 0$

$y(\pm 2\pi) = 0$

$y(2.287) = 3.495$

$y(-2.287) = -3.495$

$y(5.087) = -24.083$

$y(-5.087) = 24.083$

2. Find the extreme values of $y=\frac{\sqrt{3}}{2}x+\cos x$ on $x\in[-\pi,\pi]$

i) $\frac{dy}{dx}=\frac{\sqrt{3}}{2}-\sin x=0$

$\sin x=\frac{\sqrt{3}}{2}$

$x=\begin{cases}\pi/3\pm 2\pi n\\ 2\pi/3\pm 2\pi n\end{cases}$

ii) NEVER

iii) $x=\pm\pi$

$y(\pi)=1.721$

$y(-\pi)=-3.721$

$y(2\pi/3)=1.314$

$y(\pi/3)=1.407$

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NO CALCULATOR ALLOWED

5. $\frac{d}{dx}\cos^2(2x) = 2\cos(2x)(-\sin 2x)(2)$

(a) $2\sin(2x)\cos(2x)$
(b) $-4\sin(2x)\cos(2x)$
(c) $2\cos(2x)$
(d) $-2\cos(2x)$
(e) $-4\sin(2x)$

6. An equation of the line tangent to the graph of $y=\sin(2x)$ at $x=\frac{\pi}{2}$ is

$y' = \cos 2x\,(2)$
$= -2$

(a) $y-1=\left(x-\frac{\pi}{2}\right)$
(b) $y-1=2\left(x-\frac{\pi}{2}\right)$
(c) $y=2\left(x-\frac{\pi}{2}\right)$
(d) $y=-\left(x-\frac{\pi}{2}\right)$
(e) $y=-2\left(x-\frac{\pi}{2}\right)$

7. If $\cos x = e^y$, then $\frac{dy}{dx} =$

$y = \ln\cos x$
$\frac{dy}{dx} = \frac{1}{\cos x}(-\sin x)$

(a) $-\tan x$ (b) $-\cot x$ (c) $\cot x$ (d) $\tan x$ (e) $\csc x$

8. If $f(x)=\sin(3x)$, then $f'\left(\frac{\pi}{9}\right) =$ $\cos(3x)\cdot 3 = 3\cos\pi/3 = 3\left(\frac{1}{2}\right)$

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$ (c) $-\frac{\sqrt{3}}{2}$ (d) $-\frac{3}{2}$ (e) $-\frac{1}{2}$

Free Response (10 pts. each)

3. List the traits **and** sketch $y=\frac{\sqrt{3}}{2}x+\cos x$ on $x\in[-\pi,\pi]$

Domain: $x\in[-\pi,\pi]$

Range: $y\in[-3.721,\ 1.721]$

Axis Points: $\cos x=0$ $x=\pm\frac{\pi}{2}\pm 2\pi n$ $\left(\frac{\pi}{2},\ 1.360\right)$

Extreme Points: SEE #2 $\left(-\frac{\pi}{2},\ -1.360\right)$

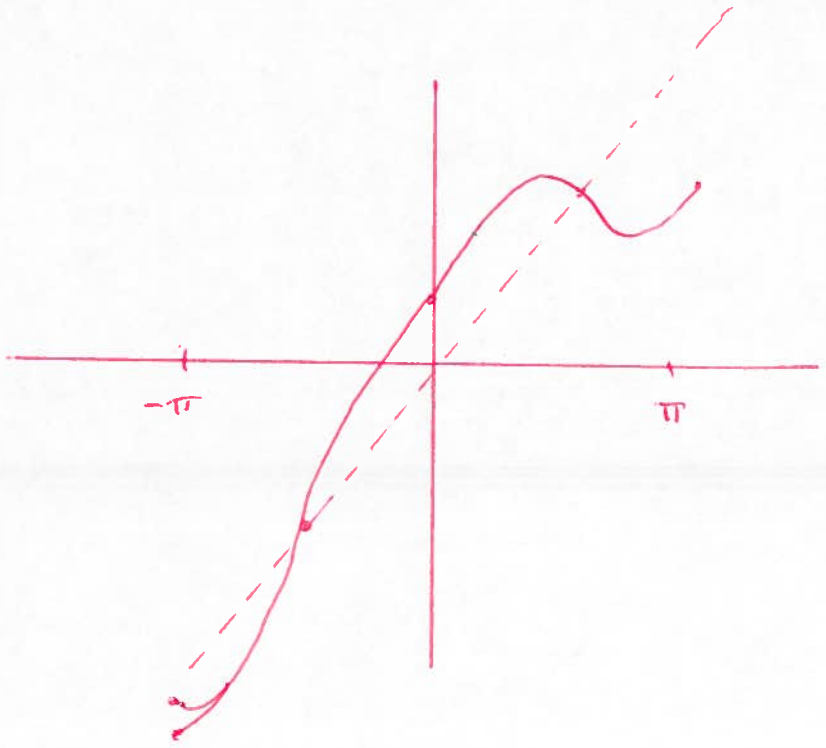
$\left(\frac{3\pi}{2},\ 4.084\right)$

$\left(-\frac{3\pi}{2},\ -4.084\right)$

VAs: NONE

POEs: NONE

End Behavior: NONE



4. List the traits **and** sketch $y = x^2 \sin x$ on $x \in [-2\pi, 2\pi]$.

Domain: $x \in [-2\pi, 2\pi]$

Range: $y \in [-24.053, 24.083]$

Axis Points: $(\pm 2\pi, 0), (\pm\pi, 0), (0,0)$

Extreme Points: See # 1

VAs: NONE

POEs: NONE

End Behavior: NONE