

# 数学作业纸

(科目: Calculus)

班级: CS 01

姓名: 李逸航

编号: 2020010869

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Problem A.

Sol.

Function

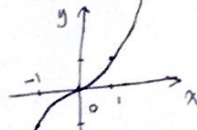
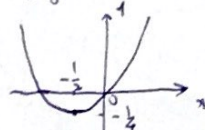
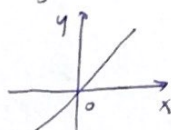
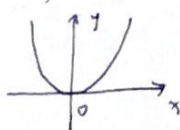
$$f(x) = x^2$$

$$g(x) = x$$

$$(f+g)(x) = x^2 + x$$

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

Graph



Range:

$$[0, +\infty)$$

$$(-\infty, +\infty)$$

$$[-\frac{1}{4}, +\infty)$$

$$(-\infty, +\infty)$$

Problem B.

Sol.

Function

$$f(x) = 2$$

$$g(x) = x^2 + 1$$

$$\frac{f}{g}(x) = \frac{2}{x^2 + 1}$$

$$\frac{g}{f}(x) = \frac{x^2 + 1}{2}$$

Domain

$$(-\infty, +\infty)$$

$$(-\infty, +\infty)$$

$$(-\infty, +\infty) \text{ since } g(x) \neq 0$$

$$(-\infty, +\infty) \text{ since } f(x) \neq 0$$

Range:

$$2$$

$$[1, +\infty)$$

$$(0, 2]$$

$$[\frac{1}{2}, +\infty)$$

Problem C

Sol.

Function

$$29$$

$$y = \sqrt{x+4}$$

$$31$$

$$y = |x-2|$$

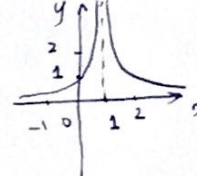
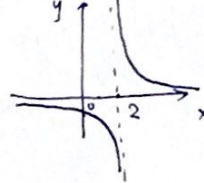
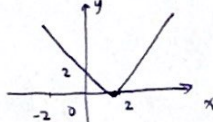
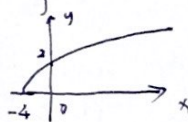
$$41$$

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

$$45$$

$$y = \frac{1}{(x-1)^2}$$

Graph



Problem D.

Sol.

Function

$$f(x) - 1$$

$$-f(x)$$

$$f(x-1)$$

$$-f(x+1) + 1$$

Domain

$$[0, 2]$$

$$[0, 2]$$

$$[1, 3]$$

$$[-1, 1]$$

Range

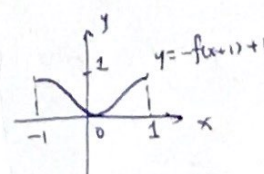
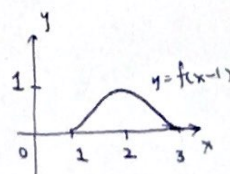
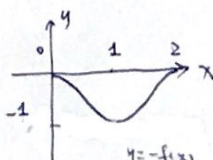
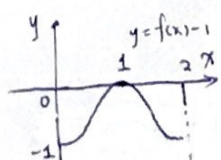
$$[-1, 0]$$

$$[-1, 0]$$

$$[0, 1]$$

$$[0, 1]$$

Graph



# 数学作业纸

(科目: Calculus)

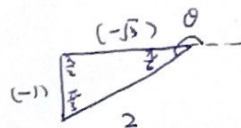
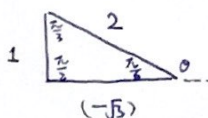
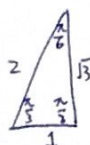
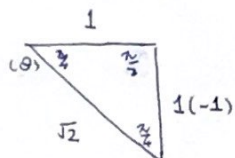
班级: CS01

姓名: 谷逸朗

编号: 2020010869

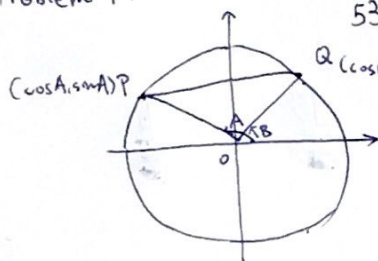
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Problem E.



$\theta$	$-\frac{\pi}{4}$	$\frac{\pi}{3}$	$\frac{5\pi}{6}$	$\frac{7\pi}{6}$
$\sin \theta$	$\frac{\text{opp}}{\text{hyp}} = \frac{-1}{\sqrt{2}} = -\frac{\sqrt{2}}{2}$	$\frac{\text{opp}}{\text{hyp}} = \frac{\sqrt{3}}{2}$	$\frac{\text{opp}}{\text{hyp}} = \frac{1}{2}$	$\frac{\text{opp}}{\text{hyp}} = \frac{-1}{2} = -\frac{1}{2}$
$\cos \theta$	$\frac{\text{adj}}{\text{hyp}} = \frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$	$\frac{\text{adj}}{\text{hyp}} = \frac{1}{2}$	$\frac{\text{adj}}{\text{hyp}} = \frac{-\sqrt{3}}{2} = -\frac{\sqrt{3}}{2}$	$\frac{\text{adj}}{\text{hyp}} = \frac{-\sqrt{3}}{2} = -\frac{\sqrt{3}}{2}$
$\tan \theta$	$\frac{\text{opp}}{\text{adj}} = \frac{-1}{1} = -1$	$\frac{\text{opp}}{\text{adj}} = \frac{\sqrt{3}}{1} = \sqrt{3}$	$\frac{\text{opp}}{\text{adj}} = \frac{1}{-\sqrt{3}} = -\frac{\sqrt{3}}{3}$	$\frac{\text{opp}}{\text{adj}} = \frac{-1}{-\sqrt{3}} = \frac{\sqrt{3}}{3}$

Problem F.



53. By the law of cosines,  $|PQ|^2 = |PO|^2 + |QO|^2 - 2|PO| \cdot |QO| \cos(A-B)$   
 $\Leftrightarrow |PQ|^2 = 2 - 2\cos(A-B)$  (1)

We have  $|PQ|^2 = (\cos B - \cos A)^2 + (\sin B - \sin A)^2$   
 $= \cos^2 B + \cos^2 A - 2\cos A \cos B + \sin^2 B + \sin^2 A - 2\sin A \sin B$   
 $= 2 - 2\cos A \cos B - 2\sin A \sin B$  (2)

By eq (1) and eq (2), we can see  $2 - 2\cos A \cos B - 2\sin A \sin B = 2 - 2\cos(A-B)$ ,  
 so  $\cos(A-B) = \cos A \cos B + \sin A \sin B$ .

54. (a) As  $\cos(A-B) = \cos A \cos B + \sin A \sin B$ , Let  $A = \frac{\pi}{2}$ ,  $B = \theta$ , we have:

$$\cos\left(\frac{\pi}{2} - \theta\right) = \cos \frac{\pi}{2} \cos \theta + \sin \frac{\pi}{2} \sin \theta = 0 + \sin \theta = \sin \theta$$

Let  $\theta = A+B$ ,

$$\sin(A+B) = \cos\left(\frac{\pi}{2} - A - B\right) = \cos\left[\left(\frac{\pi}{2} - A\right) - B\right]$$

$$= \cos\left(\frac{\pi}{2} - A\right) \cos B + \sin\left(\frac{\pi}{2} - A\right) \sin B$$

$$= \sin A \cos B + \cos A \sin B$$