
Problem 1**Point 2**

Find the largest number in the domain of the function $f(x) = \sqrt{9 - (x + 1)^2}$.

a) 2

b) 3

c) 4

d) 5

Problem 2**Point 2**

Suppose $f(x) = \frac{2}{x+1}$, $g(x) = \sqrt{x+2}$ and $h(x) = x + 3$. Find the value of the composition $g \circ h \circ f$ at $x = 1$, that is find $(g \circ h \circ f)(1)$.

a) 2

b) $\sqrt{8}$ c) $\sqrt{6}$

d) 7

Problem 3**Point 1**

For what value of the constant c is the function $f(x)$ continuous

$$f(x) = \begin{cases} 3x + c & \text{for } x < 2 \\ cx^2 - 2x + 4 & \text{for } x \geq 2 \end{cases} ?$$

a) 1

b) 2

c) 3

d) 4

Problem 4

Point 3

$$\lim_{h \rightarrow 0} \frac{(2+h)^4 - 2^4}{h} =$$

a) 32

b) 16

c) 8

d) 64

Problem 5

Point 1

Find $f'(1)$ for $f(x) = x^2 - 2\sqrt{x} + \frac{3}{x^3}$.

a) 0

b) -6

c) -2

d) -8

Problem 6**Point 1**

$$\frac{d}{dx} \ln(1 + x^2)$$

a) $2x \ln(1 + x^2)$

b) $e^{-(1+x^2)}$

c) $\frac{2x}{1+x^2}$

d) $(1 + x^2)^2$

Problem 7**Point 2**

Find the 4th derivative of $f(x) = x^3 + 2x + \cos 2x$ at $x = 0$, that is find $f^{(4)}(0)$.

a) 4

b) 16

c) 8

d) -1

Problem 8**Point 2**

Suppose the derivative of a function $f(x)$ is $f'(x) = x^2 + x - 6$. Which of the following statements is correct?

- a) $f(x)$ is increasing $-3 < x < 2$
- b) $f(x)$ is decreasing $x < 2$
- c) $f(x)$ is decreasing $-3 < x < 2$
- d) $f(x)$ is increasing $-3 < x$

Problem 9**Point 3**

What is the equation of the tangent line of the graph of $f(x) = x \cdot \ln x$ at the point $x = 1$?

- a) $y = x - 1$
- b) $y = x - 2$
- c) $y = 2x$
- d) $y = x + 2$

Problem 10**Point 2**

Let $f(x) = x^3 - 9x^2 - 16x + 1$ and $g(x) = x^3 - 0.5x^2 + x$. Find the value of x where the tangent line of the graph of $f(x)$ is parallel to the tangent line of the graph of $g(x)$.

- a) -4 b) 1.5 c) -1 d) -2

Problem 11**Point 2**

Which of the following matrices is the inverse of $\begin{pmatrix} 1 & 3 \\ 0 & -1 \end{pmatrix}$?

- a) $\begin{pmatrix} 1 & 3 \\ 0 & -1 \end{pmatrix}$
b) $\begin{pmatrix} 1 & 0 \\ 3 & -1 \end{pmatrix}$
c) $\begin{pmatrix} -1 & 3 \\ 0 & 1 \end{pmatrix}$
d) $\begin{pmatrix} -1 & 0 \\ 3 & 1 \end{pmatrix}$

Problem 12**Point 2**

Find x and y if $\begin{pmatrix} -2 & 3 \\ 4 & -5 \end{pmatrix} \cdot \begin{pmatrix} x & 2 \\ 7 & y \end{pmatrix} = \begin{pmatrix} 23 & 5 \\ -39 & -7 \end{pmatrix}$

- a) $x = -2, y = -5$ b) $x = -1, y = 3$ c) $x = -10, y = 2$ d) $x = 23, y = 7$

Problem 13**Point 3**

If a real number x is chosen at random in the interval $[0, 3]$ and a real number y is chosen at random in the interval $[0, 4]$, what is the probability that $x < y$?

- a) $\frac{9}{16}$ b) $\frac{2}{3}$ c) $\frac{3}{8}$ d) $\frac{5}{8}$

Problem 14**Point 1**

Of the three numbers, second is twice the first and is also the half of the third. Find the median if the average of the three numbers is 56.

- a) 48 b) 24 c) 96 d) 168

Problem 15**Point 2**

Find the absolute minimum value of the function $f(x) = x^3 - 12x + 1$ on the interval $[-3, 5]$.

- a) -9 b) -15 c) -17 d) -13

Problem 16**Point 3**

Given $f(x) = x \cdot e^x$. Find any local maxima, local minima and any inflection point (that is a point where $f''(x) = 0$).

- a) Local minimum at $x = -1$, local maximum at $x = -2$, inflection point at $x = 0$
b) Local minimum at $x = -1$, no maximum, inflection point at $x = -2$
c) Local minimum at $x = 0$, no local maximum at $x = -2$, inflection point at $x = -2$
d) No local minimum, local maximum at $x = -1$, inflection point at $x = -2$

Problem 17

Point 1

Two numbers have a sum 12. How large can their product be?

a) 18

b) 18

c) 24

d) 36

Problem 18

Point 2

Find the linear approximation to the function $f(x) = e^{3x} \cdot \sin 3x$ at the base point $a = 0$.

a) $y = 1 + x$

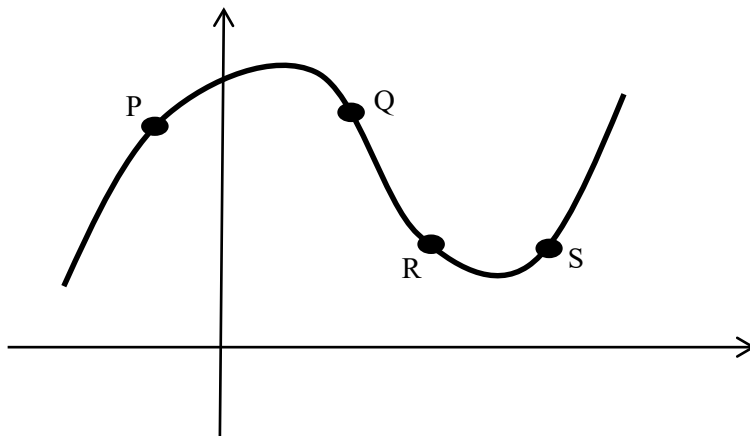
b) $y = 1 + 3x$

c) $y = 1 - 5x$

d) $y = 3x$

Problem 19**Point 3**

The graph of $f(x)$ is shown. At which marked points are all three numbers $f(x)$, $f'(x)$, $f''(x)$ positive?



a) P

b) Q

c) R

d) S

Problem 20**Point 2**

Let $f(x) = x^2 - 5x$. Find the slope of the secant line from the point where $x = -1$ to the point where $x = 1$.

a) 2

b) -2

c) -5

d) 5