

Topic: Limits of composites

Question: If $f(x) = x^3$ and $g(x) = x^2 + 3$, evaluate the limit.

$$\lim_{x \rightarrow 5} f(g(x))$$

Answer choices:

A $\lim_{x \rightarrow 5} f(g(x)) = 21,952$

B $\lim_{x \rightarrow 5} f(g(x)) = 81$

C $\lim_{x \rightarrow 5} f(g(x)) = 15,628$

D $\lim_{x \rightarrow 5} f(g(x)) = 253$



Solution: A

First find the composite $f(g(x))$, when $f(x) = x^3$ and $g(x) = x^2 + 3$.

$$f(x) = x^3$$

$$f(g(x)) = (x^2 + 3)^3$$

Then find the limit of the composite function.

$$\lim_{x \rightarrow 5} f(g(x))$$

$$\lim_{x \rightarrow 5} (x^2 + 3)^3$$

$$(5^2 + 3)^3$$

$$28^3$$

$$21,952$$



Topic: Limits of composites

Question: If $f(x) = \cos x$ and $g(x) = x + 4$, evaluate the limit.

$$\lim_{x \rightarrow -4} f(g(x))$$

Answer choices:

A $\lim_{x \rightarrow -4} f(g(x)) = -1$

B $\lim_{x \rightarrow -4} f(g(x)) = 0$

C $\lim_{x \rightarrow -4} f(g(x)) = 1$

D The limits does not exist (DNE)



Solution: C

First find the composite $f(g(x))$, when $f(x) = \cos x$ and $g(x) = x + 4$.

$$f(x) = \cos x$$

$$f(g(x)) = \cos(x + 4)$$

Then find the limit of the composite function.

$$\lim_{x \rightarrow -4} f(g(x))$$

$$\lim_{x \rightarrow -4} \cos(x + 4)$$

$$\cos(-4 + 4)$$

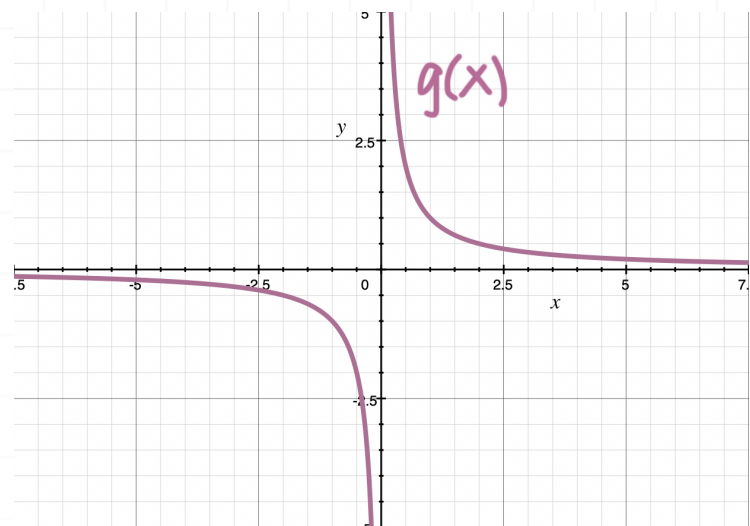
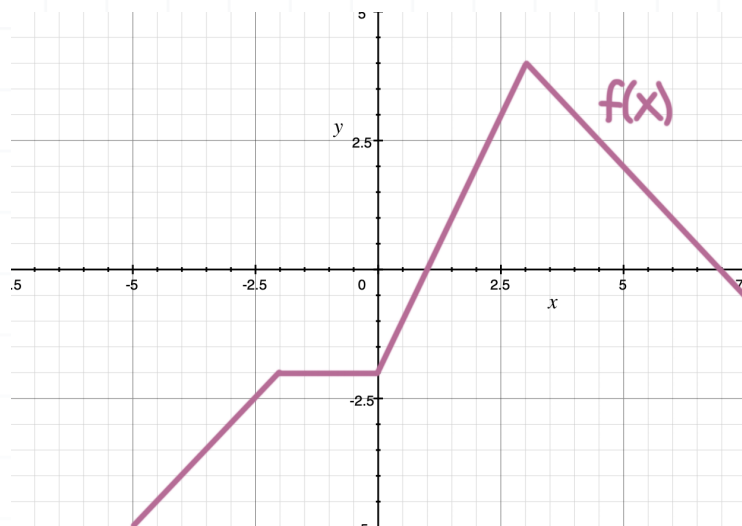
$$\cos(0)$$

$$1$$



Topic: Limits of composites

Question: Given the graphs of $f(x)$ and $g(x)$, find $\lim_{x \rightarrow 0} f(g(x))$.



Answer choices:

- A $\lim_{x \rightarrow 0} f(g(x)) = 0$
- B $\lim_{x \rightarrow 0} f(g(x)) = \infty$
- C $\lim_{x \rightarrow 0} f(g(x)) = -2$
- D $\lim_{x \rightarrow 0} f(g(x)) = \text{DNE}$



Solution: D

Use the theorem for limits of composite functions.

$$\lim_{x \rightarrow 0} f(g(x)) = f(\lim_{x \rightarrow 0} g(x))$$

From the graph of $g(x)$, we can see that

$$\lim_{x \rightarrow 0} g(x) = \text{DNE}$$

Therefore, $\lim_{x \rightarrow 0} f(g(x))$ does not exist.

