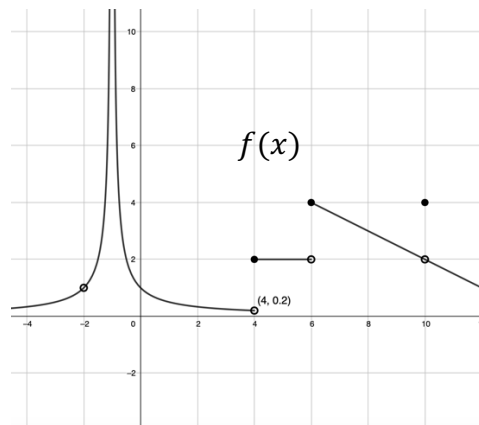# Thanksgiving Calculus

Directions: Solve each problem and color the corresponding regions on the coloring page based on the answer you got. For example, if you think the answer to question 1 is

1. For $-4 < x < 12$, for which values of x does $f(x)$ have a removable discontinuity?

$f(x)$

(4, 0.2)

| $x = -2, 4, 6, 10$ | $x = -1, 4, 6$ | $x = -2, 10$ | $x = 10$ only |
| Red | Blue | Purple | Dark Green |

2. Find $\lim\limits_{x \to 4} \dfrac{x^2 - 3x - 4}{x^2 - 10x + 24}$ $= \lim\limits_{x \to 4} \dfrac{(x-4)(x+1)}{(x-4)(x-6)} = \lim\limits_{x \to 4} \dfrac{(x+1)}{(x-6)} = \dfrac{5}{-2}$

| $-5/2$ | ½ | 0 | Does not exist |
| Blue | Yellow | Pink | Brown |

3. Consider the closed curve in the xy-plane given by $x^2 + 8x + y^3 - 4y = -16$. Find the slope of the line tangent to the curve at $(-2, 1)$.

| 20 | 4 | 0 | -4 |
| Purple | Red | Yellow | Pink |

$2x + 8 + \dfrac{dy}{dx}(3y^2) - 4\dfrac{dy}{dx} = 0$

$\dfrac{dy}{dx} = \dfrac{-2x-8}{3y^2-4}$

$\dfrac{dy}{dx}\Big|_{(-2,1)} = \dfrac{-4}{-1} = 4$

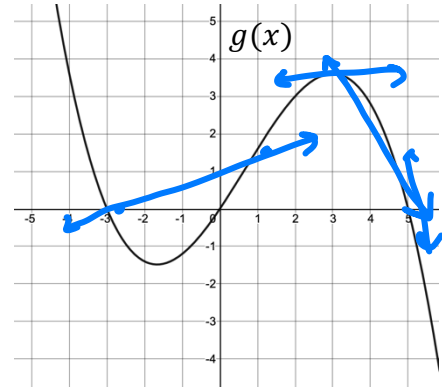Math Medic

4. The graph of $g(x)$ is shown. Order the following from least to greatest:

A) $\lim\limits_{h\to 0} \dfrac{g(3+h)-g(3)}{h}$ ~~0~~

B) Average rate of change of $g(x)$ on [3,5] ~~neg~~

C) $g'(5)$ ~~very neg~~

D) $\dfrac{g(1)-g(-3)}{1-(-3)}$ ~~pos~~

g(x)

A, D, B, C	C, B, A, D	B, C, A, D	C, A, D, B
Blue	Orange	Red	Purple

5. A particle's position on the x-axis is given by $x(t) = \frac{1}{3}t^3 - \frac{7t^2}{2} + 10t + 4$, where x is measured in meters and t is measured in seconds. For which values of t is the particle speeding up?

$t = 0.5$	$t = 3$	$t = 4$	$t = 5$
Black	Dark green	Orange	Brown

$v(t) = t^2 - 7t + 10$ $a(t) = 2t - 7$

$v(t)$ + ___ − ___ +
        −2   5+

$a(t)$ ___
        3.5

$v(t) = 0 \Rightarrow t = 2, 5$
$a(t) = 0 \Rightarrow t = 3.5$

6. Advertisers try to measure the Click-Through Rate (CTR) for their ads, which gives the ratio of people who click on an ad (Total Clicks on Ad) compared to the people who see the ad (Total Impressions). For example, a CTR of 0.05 means that 5% of the people seeing the ad actually click on the ad and follow the link. A company initiates a new marketing strategy in the hope of increasing their CTR score. Let $C(t)$ represent the company's CTR, t weeks into the initiative. What are the units of $C'(t)$?

$\dfrac{clicks}{impression}$	$\dfrac{clicks}{week}$	$\dfrac{clicks/impression}{week}$	$\dfrac{clicks}{impression^2}$
Red	Blue	Light green	Orange

Math Medic

Selected values of $f(x), g(x)$ and their derivatives are given in the table below. Use the table to answer questions 7-9.

x	$f(x)$	$g(x)$	$f'(x)$	$g'(x)$
-3	8	6	5	1
0	-1	2	11	9
2	-3	5	-4	-12
7	4	0	2	-6

7. If $h(x) = f(g(x))$, find $h'(7)$.

-12	-66	11	-24
Yellow	Black	Blue	Red

$g'(7) \cdot f'(g(7)) = -6 \cdot f'(0) = -6 \cdot 11 = -66$

8. If $k(x) = f^{-1}(x)$, find $k'(-3)$.

$-1/4$	$1/5$	5	-4
Brown	Light Green	Orange	Purple

$k'(-3) = \dfrac{1}{f'(2)} = \dfrac{1}{-4}$

9. If $j(x) = (3f(x) - 1)^3$, find $j'(2)$.

507	300	-5184	-3600
Black	Pink	Dark green	Yellow

$j'(x) = 3f'(x) \cdot 3(3f(x) - 1)^2$

$j'(2) = 3 \cdot (-4) \cdot 3(3 \cdot -3 - 1)^2 = -12 \cdot 3(-10)^2$
$= -12 \cdot 300 = -3600$

10. Write the equation of the line tangent to $y = \sin(2x)$ at $x = \frac{5\pi}{6}$.

$y + \frac{\sqrt{3}}{2} = \frac{1}{2}(x - \frac{5\pi}{6})$	$y - \frac{1}{2} = (x - \frac{5\pi}{6})$	$y + \frac{\sqrt{3}}{2} = (x - \frac{5\pi}{6})$	$y - \frac{\sqrt{3}}{2} = \frac{1}{2}(x - \frac{5\pi}{6})$
Brown	Blue	Pink	Orange

$\sin\left(\frac{10\pi}{6}\right) = \frac{-\sqrt{3}}{2}$

$y' = 2\cos(2x)$ $y'\big|_{x = \frac{5\pi}{6}} = 2\cos\left(\frac{10\pi}{6}\right) = 2 \cdot \frac{1}{2} = 1$

Math Medic

©NicoleFlorian

Math Medic