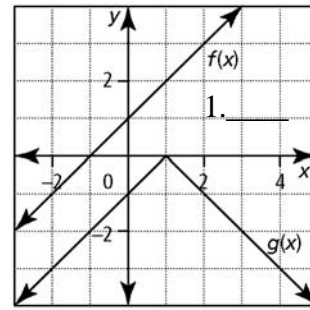## Pre-Calculus

1. From the graph, what is the value of $(f - g)(2)$?

1._____

    (A) –3
    (B) 0
    (C) 2
    (D) 4

2. Given $f(x) = x^2 + 2$ and $g(x) = x - 5$, which equation represents $h(x) = (f + g)(x)$?

    (A) $h(x) = 2x^2 - 5$ (B) $h(x) = x^2 + x - 3$

    (C) $h(x) = x^2 + x - 5$ (D) $h(x) = x^2 + 2x - 5$

3. Let $f(x) = x - 1$ and $g(x) = x^2 - 1$. Determine the non-permissible values

of $y = \left(\dfrac{f}{g}\right)(x)$.

    (A) 1   (B) –1   (C) ± 1 (D) none

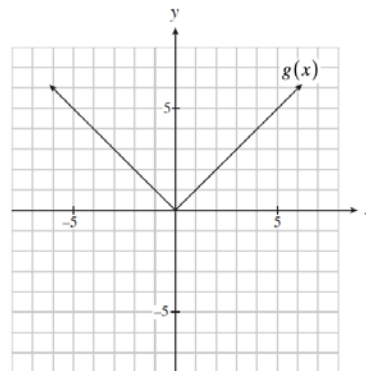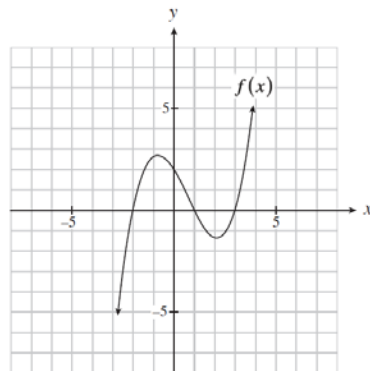• If $f(x) = \sqrt{3x-1}$ and $g(x) = x^2$, which is the domain of $m(x) = \dfrac{g(x)}{f(x)}$?

    (A) $\{x \mid x > 0, x \in R\}$ (B) $\{x \mid x \neq 0, x \in R\}$

    (C) $\left\{x \mid x > \dfrac{1}{3}, x \in R\right\}$ (D) $\left\{x \mid x \neq \dfrac{1}{3}, x \in R\right\}$

5. Given $f(x) = x + 2$ and $g(x) = x^2 + 3x - 1$, determine the value of $f(g(3))$.
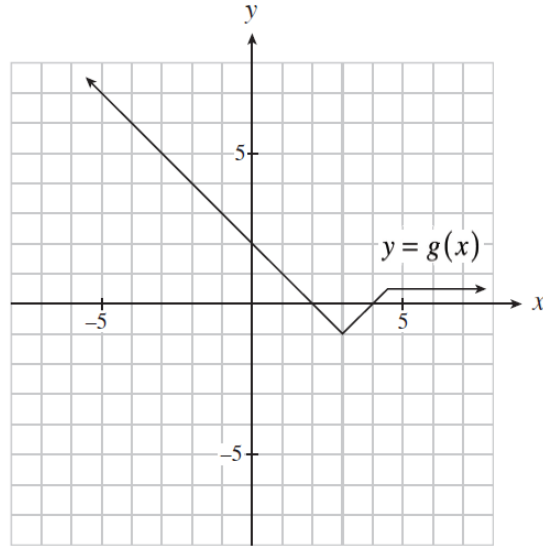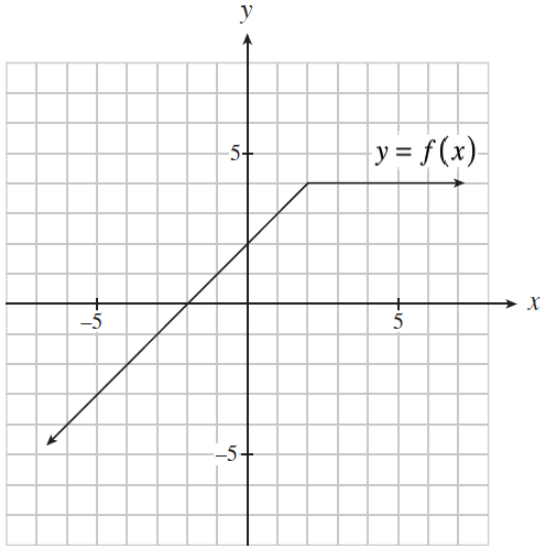
    (A) 16   (B) 17   (C) 19   (D) 39

6. The graphs of f(x) and g(x) are given below. Determine f(g(-3)).

    (A) -6
    (B) –2
    (C) 0
    (D) 3

7. Given the functions $f(x) = 4x - 6$ and $g(x) = (x-2)^2$, determine $h(x) = f(x) - g(x)$.

8. Given the function $f(x) = 2x^2 - 3x + 7$, determine $f(x+h) - f(x)$.

9. Use the graphs of $y = f(x)$ and $y = g(x)$ shown to sketch the graph of $y = f(x)g(x)$. Clearly indicate a sufficient number of points to get an accurate representation of your graph.

10.

Consider the functions $f(x) = x^2 + 6x + 8$ and $g(x) = x + 4$.

(i) Determine the equation of the function $h(x) = \dfrac{f(x)}{g(x)}$.

(ii) State the domain and range of $h(x)$.

11. Given $f(x) = x + 1$, $g(x) = x - 5$, and $h(x) = x - 4$, determine each combined function.

(i) $y = f(x)g(x)h(x)$ **(ii)** $y = \dfrac{f(x)g(x)}{h(x)}$

12. Given $f(-1) = 7$, $f(7) = 5$, $f(3) = 0$, $g(-1) = 3$, $g(7) = -1$, and $g(5) = -2$, find each value.

a) $f(g(7))$ **b)** $f(g(-1))$

14. Given $f(x) = \sqrt{x}$ and $g(x) = x^2 - 1$, $h(x) = \dfrac{1}{x}$, determine

a) $g(f(x))$ and state the domain   b) $h(f(x))$ and state the domain

15. Find two functions, $f(x)$ and $g(x)$, such that $f(g(x)) = (2x + 3)^2 - 5$.

Limits & Continuity

16. Determine the x-values (if any) at which f is not continuous. Which of the discontinuities are removable?

a. $f(x) = \dfrac{x}{x^2 - x}$

b. $f(x) = \begin{cases} 2x+1, & x \geq -2 \\ \dfrac{2x}{x+2}, & x < -2 \end{cases}$

17. For what value(s) of "k" is the following function continuous everywhere?

$$f(x) = \begin{cases} kx^2 + 1, & x > 2 \\ -x , & x \leq 2 \end{cases}$$

18. Find the values of a and b such that $f(x)$ is continuous.

$$f(x) = \begin{cases} ax+1, & x < 2 \\ bx-1 , & x = 2 \\ ax+b-6, & x > 2 \end{cases}$$

19. Use the definition of continuity to determine if $f(x)$ is continuous at $x = 0$. Find any other points of discontinuity and state the type.

$$f(x) = \begin{cases} \dfrac{x-3}{x^2-1}, & x < 0 \\ 2x+1, & x = 0 \\ (x+2)^2 - 1, & x > 0 \end{cases}$$

20. Use the definition of continuity to determine if $f(x)$ is continuous at $x = 1$

$$f(x) = \begin{cases} x^2 + 1, & x < 1 \\ 2x , & x = 1 \\ 3x^2 - 1 , & x > 1 \end{cases}$$

21. Evaluate the following limits, showing the workings. Assign ∞ or $-\infty$ as appropriate.

(A) $\displaystyle\lim_{x \to -\infty} \dfrac{3x+1}{\sqrt{4x^2-5}}$

(B) $\displaystyle\lim_{x \to -1^-} \dfrac{2x^2+x-1}{x^2+2x+1}$

(C) $\displaystyle\lim_{x \to -2} \dfrac{3-\sqrt{x+7}}{x-2}$

(D) $\displaystyle\lim_{x \to 1} \dfrac{2x+\sqrt{x^2+3}}{\sqrt{x^3+1}}$

(E) $\displaystyle\lim_{x \to -3^-} \dfrac{x+3}{|x+3|}$

22.	Use the graph of $y = f(x)$ below to determine each of the following. Label the limits as ∞ or $-\infty$ where appropriate. If the limit does not exist or the value of the function is undefined, indicate this.

(a) $f(0) =$

(b) $\lim\limits_{x \to 0^-} f(x) =$

(c) $\lim\limits_{x \to 0^+} f(x) =$

(d) $\lim\limits_{x \to 0} f(x) =$

(e) $f(-2) =$

(f) $\lim\limits_{x \to -2^-} f(x) =$
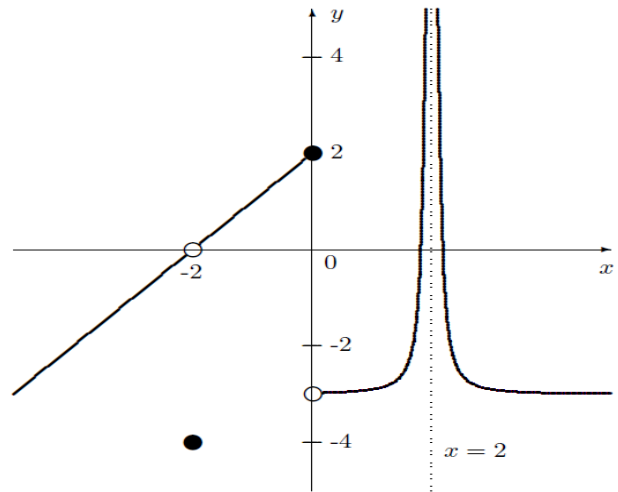
Rational Functions

23.	For each function below

a.	Find the horizontal and vertical asymptotes of the function.

b.	Determine x and y intercepts.		c.	Determine any POD.

d.	Sketch

A)	$f(x) = \dfrac{2x - 2}{x^2 - 1}$

B)	$f(x) = \dfrac{x^2 - 9}{x^2 + 2x - 3}$

The Derivative

24.	For each function given, determine whether $f(x)$ is continuous and whether $f(x)$ is differentiable at the given x value.

(a)	$f(x) = \begin{cases} x^2 + 2 & \text{if } x \le -1 \\ -2x + 1 & \text{if } x > -1 \end{cases}$

(b)	$f(x) = \begin{cases} \dfrac{4x^2 - 8x + 4}{x^2 - 1} & \text{if } x < 1 \\ 3x^2 - 4x + 1 & \text{if } x \ge 1 \end{cases}$

25.	Using the Limit Definition of the derivative, differentiate the following functions.

(a)	$f(x) = 2x^2 + 3x + 5$

(b)	$f(x) = \sqrt{3 + 2x}$

(c)	$f(x) = \dfrac{1}{x}$

26   If an arrow is shot upward on the moon with a velocity of 58 m/s, its height (in meters) after t seconds is given by $h(t) = 58t - 0.83t^2$.

    (a)   What is the instantaneous velocity at $t = 1$s?
    (b)   What is the instantaneous velocity at $t = 3$s?
    (c)   What is the average velocity from $t = 1$s to $t = 3$s?

27.   (a)   Determine the equation of the tangent line to the curve $y = x^3 - 2x + 1$ at the point $(-1, 2)$.

    (b)   Determine the equation of the normal line (to the same curve at the same point).   [2]

28.   The position of a particle is given by the function $s(t) = t^3 - 9t^2 + 15t$ where t is measured in seconds and s is measured in feet.

    (a) Determine the velocity at time t.   (b) What is the velocity at $t = 3$ seconds?

    (c) When is the particle at rest?   (d) When is the particle moving in a positive direction?

    (e) Determine the acceleration at time t.   (f) When is the particle speeding up?

29. Differentiate the following.

    (a) $y = (x^2 - 4x)(3x^2 + 5x + 2)$ (b) $y = 3\sqrt{x}\,(2 - x^2)$ c. $y = \sqrt{3x - 1}$

30. Differentiate the following.

    (a) $2x + 3y^2 = 1$ (b) $x^3 - 5xy^2 = 2y$ c. $y = \dfrac{x^2 + 3}{\sqrt{x}}$

Applications of the Derivative

31.   Given the function $f(x) = x^3 + 2x^2 - 4x + 1$

- Determine location of local max/min points
- Determine intervals of increase/decrease
- Determine location of inflection ppoints
- Determine intervals of concave up/down