HONS 280–01 (Kunkle), Exam 1 Name: ______________________

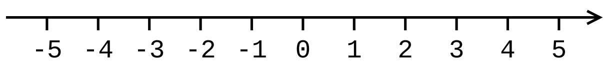
100 pts, 75 minutes Sept 15, 2026

You may use an approved calculator, but no notes, books, phones, smart watches, earbuds, other electronic devices, or any other outside material. Notes stored in your calculator in the form of programs, equations, etc., are not allowed. You may not share a calculator with another student. Do not leave the room during the exam with a phone.

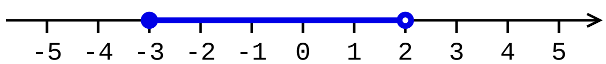
Read each problem carefully and simplify your answers.

Unless otherwise indicated, supporting work will be required on every problem worth more than 2 points.

1a(2 pts). Sketch the set $(-3, \infty)$on the number line.



1b(2 pts). Write the set pictured here in interval form:



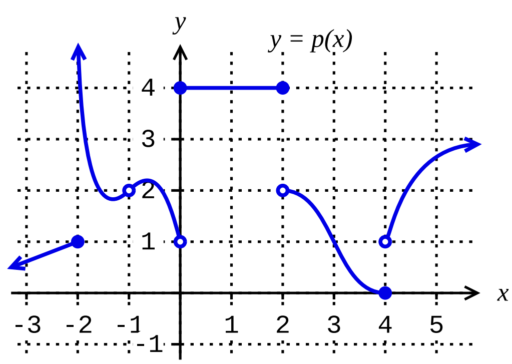
2(8 pts). Use the graph of $p(x)$ to find the following. Supporting work is not required. Your answer to a-h should be ∞, $-\infty$, a number, or "dne."

a. $p(-1)$ b. $p(1)$

c. $\lim_{x\to 3} p(x)$ d. $\lim_{x\to 4} p(x)$

e. $\lim_{x\to 0^-} p(x)$ f. $\lim_{x\to 0^+} p(x)$

g. $\lim_{x\to -2^+} p(x)$ h. $p(-2)$



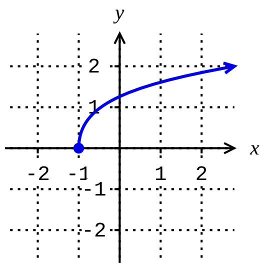
3(2 pts) At what x-values, if any, is the function $p(x)$ in problem 2 **discontinuous**?

4(16 pts). Find all solutions x to each of the given equations.

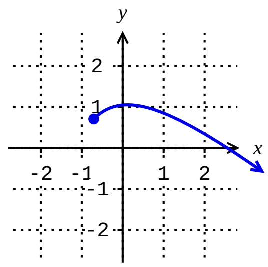
a. $2(x-2)+3 = 5(3-x)$ b. $|x| = 13$ c. $\dfrac{3}{2x} + \dfrac{1}{5} = \dfrac{4}{5x}$

d. $8x^2 + 5x + 3 = 2x^2 + 7$ e. $(x+4)^2 = 9$

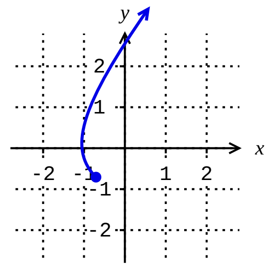
5(4 pts). Determine whether the given curve is the graph of a function $y = f(x)$.



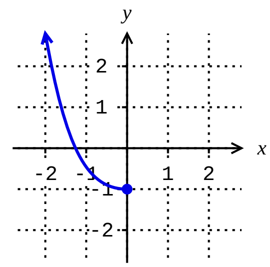
(circle one)
Function
Not a function



(circle one)
Function
Not a function



(circle one)
Function
Not a function



(circle one)
Function
Not a function

6(3 pts). Find the average rate of change of the function $r(x) = \frac{2}{3x-1}$ between $x_1 = \frac{1}{2}$ and $x_2 = 1$.

7(8 pts). Expand the polynomial. That is, rewrite the polynomial without parentheses.

a. $(2x-5)(5x+2)$ b. $(x-3)^2$

8(4 pts). Simplify the expression $\frac{x^{-2} \cdot x^{3/4}}{(x^2)^3}$. Write your answer so that the variable doesn't appear in the denominator.

9(8 pts). Let $g(x) = \frac{x-4}{2x}$ and $h(x) = \frac{1}{x}$. Find and simplify the following.

a. $h(g(x))$ b. $h(x)g(x)$ c. $\dfrac{g(x)}{h(x)}$

10(8 pts). Find an equation of the line described in each part.

a. The line passing through the points $(-2, 3)$ and $(10, 0)$.
b. The line passing through the origin $(0, 0)$ that is perpendicular to the line $5x - 2y = 7$.

11(9 pts). A baker finds that when she prices her cakes at \$40 each, she sells 150 cakes. When she prices her cakes at \$60, she sells only 90 cakes.

a. Find her demand function $D(x)$, assuming it is linear.

b. What is her revenue function?

12(6 pts). A puppet-maker sells his puppets for 100 dollars each. To produce x puppets in a month costs him $C(x) = 1620 + 80x$ dollars. What number of puppets is his break-even point?

13(20 pts). Evaluate the given limit or explain why it does not exist.

a. $\displaystyle\lim_{x\to 2^-} \frac{x-5}{x-2}$ b. $\displaystyle\lim_{x\to 2^+} \begin{cases} x^2+6 & \text{if } x<2 \\ 3-2x & \text{if } 2 \le x \end{cases}$

c. $\displaystyle\lim_{x\to 2} \frac{x-2}{x^2-7x+10}$ d. $\displaystyle\lim_{x\to -\infty} \frac{2x^2+9x}{3x+4}$

HONS 280–01 (Kunkle), Exam 1 Name: ____________________

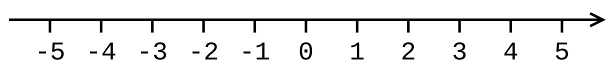
100 pts, 75 minutes Sept 15, 2026

You may use an approved calculator, but no notes, books, phones, smart watches, earbuds, other electronic devices, or any other outside material. Notes stored in your calculator in the form of programs, equations, etc., are not allowed. You may not share a calculator with another student. Do not leave the room during the exam with a phone.

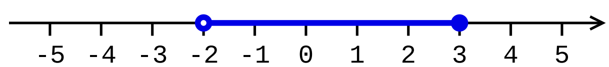
Read each problem carefully and simplify your answers.

Unless otherwise indicated, supporting work will be required on every problem worth more than 2 points.

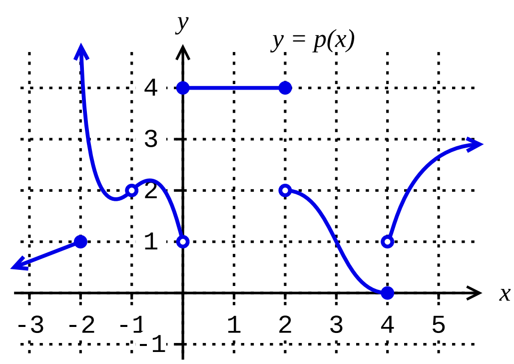
1a(2 pts). Sketch the set $(-\infty, 3)$on the number line.



1b(2 pts). Write the set pictured here in interval form:



2(8 pts). Use the graph of $p(x)$ to find the following. Supporting work is not required. Your answer to a-h should be ∞, $-\infty$, a number, or "dne."



a. $\lim\limits_{x\to -2^+} p(x)$ b. $p(-2)$

c. $\lim\limits_{x\to 0^-} p(x)$ d. $\lim\limits_{x\to 0^+} p(x)$

e. $\lim\limits_{x\to 3} p(x)$ f. $\lim\limits_{x\to 4} p(x)$

g. $p(-1)$ h. $p(1)$

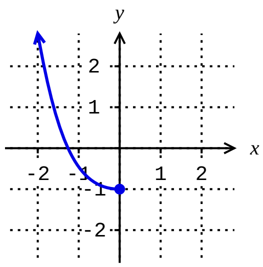
3(2 pts) At what x-values, if any, is the function $p(x)$ in problem 2 **discontinuous**?

4(16 pts). Find all solutions x to each of the given equations.

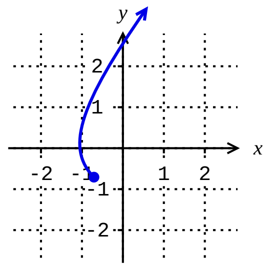
a. $2(x-2)+3 = 7(3-x)$ b. $|x| = -12$ c. $\dfrac{4}{2x} + \dfrac{1}{5} = \dfrac{3}{5x}$

d. $8x^2 - 5x + 3 = 2x^2 + 7$ e. $(x-3)^2 = 16$

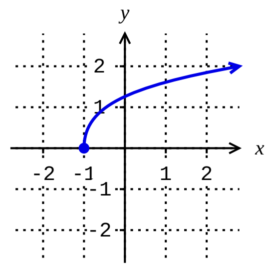
5(4 pts). Determine whether the given curve is the graph of a function $y = f(x)$.



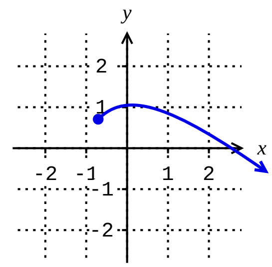
(circle one)
Function
Not a function



(circle one)
Function
Not a function



(circle one)
Function
Not a function



(circle one)
Function
Not a function

6(3 pts). Find the average rate of change of the function $r(x) = \frac{2}{3x-1}$ between $x_1 = \frac{1}{2}$ and $x_2 = 1$.

7(8 pts). Expand the polynomial. That is, rewrite the polynomial without parentheses.

a. $(2x + 5)(5x - 2)$ b. $(x - 2)^2$

8(4 pts). Simplify the expression $\frac{x^{-2} \cdot x^{3/4}}{(x^2)^3}$. Write your answer so that the variable doesn't appear in the denominator.

9(8 pts). Let $g(x) = \frac{2x}{x-4}$ and $h(x) = \frac{1}{x}$. Find and simplify the following.

a. $h(g(x))$ b. $h(x)g(x)$ c. $\dfrac{h(x)}{g(x)}$

10(8 pts). Find an equation of the line described in each part.

a. The line passing through the points $(-2, 4)$ and $(10, 0)$.
b. The line passing through the origin $(0, 0)$ that is parallel to the line $5x - 2y = 7$.

11(9 pts). A baker finds that when she prices her cakes at \$40 each, she sells 120 cakes. When she prices her cakes at \$60, she sells only 60 cakes.

a. Find her demand function $D(x)$, assuming it is linear.

b. What is her revenue function?

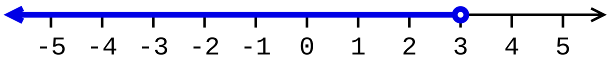
12(6 pts). A puppet-maker sells his puppets for 100 dollars each. To produce x puppets in a month costs him $C(x) = 1480 + 80x$ dollars. What number of puppets is his break-even point?

13(20 pts). Evaluate the given limit or explain why it does not exist.

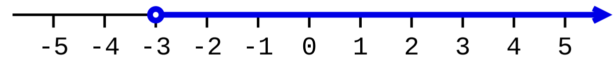
a. $\displaystyle\lim_{x\to 2^+} \frac{x-5}{x-2}$ b. $\displaystyle\lim_{x\to 2^-} \begin{cases} x^2 + 5 & \text{if } x < 2 \\ 3 - 2x & \text{if } 2 \le x \end{cases}$

c. $\displaystyle\lim_{x\to 2} \frac{x-2}{x^2 - 5x + 6}$ d. $\displaystyle\lim_{x\to -\infty} \frac{2x^2 + 9x}{3x^2 + 4}$

1a.(Source: 0.1) There were two forms of this question (and most questions on the exam). Here are both answers.

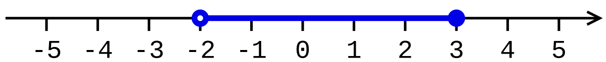


$(-\infty, 3)$

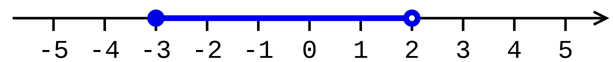


$(-3, \infty)$

1b.(Source: 0.1)



$(-2, 3]$



$[-3, 2)$

2.(Source: 2.2.4-9, 2.6.3-4) (order varies.)

$$\lim_{x\to -2^+} p(x) = \infty \qquad p(1) = 4 \qquad \lim_{x\to 0^+} p(x) = 4$$

$$\lim_{x\to 0^-} p(x) = 1 \qquad p(-2) = 1 \qquad \lim_{x\to 3} p(x) = 1$$

$\lim_{x\to 4} p(x)$ does not exist. $\qquad$ $p(-1)$ does not exist.

3.(Source: 2.4) $p(x)$ is discontinuous at $x = -2$, 0, 2, and 4, where the limit does not exist. p is also discontinuous at $x = -1$, where the limit exists but the function does not.

4a.(Source: 0.6.93)

$$\begin{aligned} 2(x-2)+3 &= 5(3-x) \\ 2x-4+3 &= 15-5x \\ 2x+5x &= 15+4-3 \\ 7x &= 16 \\ x &= \frac{16}{7} \end{aligned}$$

Alternate form:

$$\begin{aligned} 2(x-2)+3 &= 7(3-x) \\ 2x-4+3 &= 21-7x \\ 2x+7x &= 21+4-3 \\ 9x &= 22 \\ x &= \frac{22}{9} \end{aligned}$$

4b.(Source: 0.1.27,31) $|x| = 13$ implies $x = \pm 13$. Alternate form: The absolute value cannot be negative, so $|x| = -12$ has no solutions.

(Source: 0.8.17) 4c.(Source: 0.8.17) We can rewrite the equation with no fractions if we multiply both sides by $10x$:

$$\begin{aligned} 10x\left(\frac{3}{2x}+\frac{1}{5}\right) &= \frac{4}{5x}\cdot 10x \\ 10x\frac{3}{2x}+10x\frac{1}{5} &= \frac{4}{5x}\cdot 10x \\ 5\cdot 3+2x &= 4\cdot 2 \\ 15+2x &= 8 \\ 2x &= 8-15 = -7 \\ x &= -\frac{7}{2} \end{aligned}$$

Alternate form:

$$\begin{aligned} 10x\left(\frac{4}{2x}+\frac{1}{5}\right) &= \frac{3}{5x}\cdot 10x \\ 10x\frac{4}{2x}+10x\frac{1}{5} &= \frac{3}{5x}\cdot 10x \\ 5\cdot 4+2x &= 3\cdot 2 \\ 20+2x &= 6 \\ 2x &= 6-20 = -14 \\ x &= -7 \end{aligned}$$

4d.(Source: 0.7.8) Get a zero on one side and factor the other.

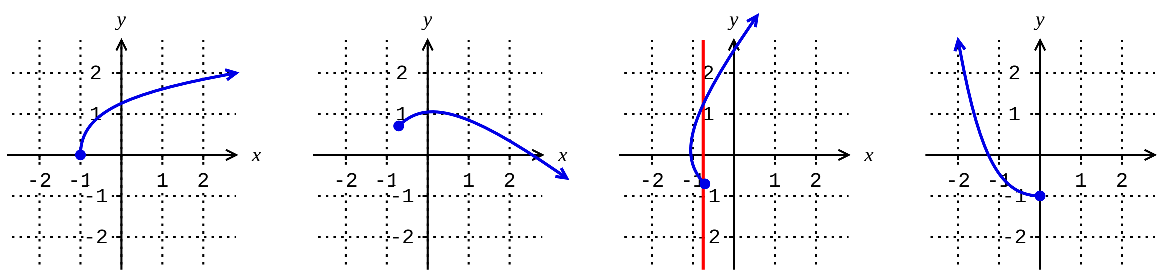
$$8x^2+5x+3=2x^2+7 \quad\Longrightarrow\quad 0=6x^2+5x-4=(3x+4)(2x-1) \quad\Longrightarrow\quad x=-\frac{4}{3} \text{ or } \frac{1}{2}$$

Alternate form:

$$8x^2-5x+3=2x^2+7 \quad\Longrightarrow\quad 0=6x^2-5x-4=(3x-4)(2x+1) \quad\Longrightarrow\quad x=\frac{4}{3} \text{ or } -\frac{1}{2}$$

4e.(Source: 0.7.13) $x+4=\pm 3$, so $x=-4\pm 3=-7$ or -1.
Alternate form: $x-3=\pm 4$, so $x=3\pm 4=7$ or -1.

5.(Source: 1.1.40-51) These graphs appear in different order on different exams.
Vertical Line Test: A curve is the graph of a function $y=f(x)$ if and only if no vertical line intersects the curve more than once.



Function Function Not a function Function

6.(Source: 2.5.10) $r(1)=\frac{2}{3-1}=1$, and $r(\frac{1}{2})=\frac{2}{\frac{3}{2}-1}=\frac{2}{\frac{1}{2}}=4$. Average rate of change is $\dfrac{r(1)-r(\frac{1}{2})}{1-\frac{1}{2}}=\dfrac{1-4}{\frac{1}{2}}=-6$.

7a.(Source: 0.4.21) FOIL: $(2x-5)(5x+2)=10x^2+4x-25x-10=10x^2-21x-10$.
Alternate form: $(2x+5)(5x-2)=10x^2-4x+25x-10=10x^2+21x-10$.
7b.(Source: 0.4.24) FOIL, or use $(a-b)^2=a^2-2ab+b^2$.
$(x-3)^2=x^2-6x+9$. Alternate form: $(x-2)^2=x^2-4x+4$.

8.(Source: 0.3.12) $\dfrac{x^{-2}\cdot x^{3/4}}{(x^2)^3}=\dfrac{x^{-2+\frac{3}{4}}}{x^{2\cdot 3}}=\dfrac{x^{-\frac{5}{4}}}{x^6}=x^{-\frac{5}{4}-6}=x^{-\frac{29}{4}}$.

9a.(Source: 1.2.21) $h(g(x))=\dfrac{1}{g(x)}=\dfrac{1}{\frac{x-4}{2x}}=\dfrac{2x}{x-4}$.

Alternate form: $h(g(x))=\dfrac{1}{g(x)}=\dfrac{1}{\frac{2x}{x-4}}=\dfrac{x-4}{2x}$.

9b.(Source: 1.2.6) $h(x)g(x)=\dfrac{1}{x}\cdot\dfrac{x-4}{2x}=\dfrac{x-4}{2x^2}$.

Alternate form: $h(x)g(x)=\dfrac{1}{x}\cdot\dfrac{2x}{x-4}=\dfrac{2}{x-4}$.

9c.(Source: 1.2.8) $\dfrac{g(x)}{h(x)}=\dfrac{\frac{1}{x}}{\frac{x-4}{2x}}=\dfrac{1}{x}\cdot\dfrac{2x}{x-4}=\dfrac{2}{x-4}$.

Alternate form: $\dfrac{h(x)}{g(x)} = \dfrac{\frac{2x}{x-4}}{\frac{1}{x}} = \dfrac{2x}{x-4} \cdot x = \dfrac{2x^2}{x-4}$.

10a.(Source: 0.5.13) The slope of the line is $\dfrac{\Delta y}{\Delta x} = \dfrac{3-0}{-2-10} = -\dfrac{1}{4}$. The line can be written in point-slope form as $y = -\frac{1}{4}(x-10)$.

Alternate form: Slope is $\dfrac{4-0}{-2-10} = -\dfrac{1}{3}$, and line is $y = -\frac{1}{3}(x-10)$.

10b.(Source: 0.5.39) Rewrite the line $5x - 2y = 7$ as $y = \frac{5}{2}x - \frac{7}{2}$, so its slope is $\frac{5}{2}$. Any line perpendicular to this has slope $-\frac{2}{5}$. Since the desired line passes through $(0,0)$, its equation is $y = -\frac{2}{5}x$.

Alternate form: Any line parallel to $y = \frac{5}{2}x - \frac{7}{2}$ has slope $\frac{5}{2}$. Since the desired line passes through $(0,0)$, its equation is $y = \frac{5}{2}x$.

11a.(Source: 1.3.37) $D(x)$ is the (greatest) price at which the baker can expect to sell x cakes. To say that $D(x)$ is linear means it is a function of the form $D(x) = mx + b$. The slope m equals

$$\frac{\Delta D}{\Delta x} = \frac{\Delta \text{ price}}{\Delta \text{quantity}} = \frac{\$40 - \$60}{150 - 90} = \frac{-20}{60} = -\frac{1}{3}.$$

Now write the demand line in point-slope form and solve for D:

$$D(x) - 40 = -\frac{1}{3}(x - 150) = -\frac{1}{3}x + 50 \quad \Longrightarrow \quad D(x) = -\frac{1}{3}x + 90.$$

The most common error on this problem was to use $x =$ price and $D(x) =$ quantity. It should be $x =$ quantity and $D(x) =$ price.

11b. Revenue equals price times quantity: $R(x) = xD(x) = -\frac{1}{3}x^2 + 90x$.

Alternate form: 11a. Slope $m =$

$$\frac{\Delta D}{\Delta x} = \frac{\Delta \text{ price}}{\Delta \text{quantity}} = \frac{\$40 - \$60}{120 - 60} = \frac{-20}{60} = -\frac{1}{3},$$

and

$$D(x) - 40 = -\frac{1}{3}(x - 120) = -\frac{1}{3}x + 40 \quad \Longrightarrow \quad D(x) = -\frac{1}{3}x + +80.$$

11b. $R(x) = xD(x) = -\frac{1}{3}x^2 + 80x$.

12.(Source: 1.3.29-32) Revenue equals price times quantity $= 100x$ and profit equals revenue minus cost $= 100x - (1620 + 80x) = 20x - 1620$. The break-even point is the x-value where profit equals zero:

$$20x - 1620 = 0 \quad \Longrightarrow \quad x = \frac{1620}{20} = 81.$$

Alternate form: Profit $= 100x - (1480 + 80x) = 20x - 1480 = 0$ at $x = \frac{1480}{20} = 74$.

13a.(Source: 2.1.49) $\lim_{x\to 2^-} \frac{x-5}{x-2} =$ "$\frac{-3}{0}$", indicating an infinite limit. To decide wether this limit is ∞ or $-\infty$, determine the sign of $\frac{x-5}{x-2}$:

$$x \to 2^- \implies x < 2 \implies x - 2 < 0 \implies \frac{x-5}{x-2} = \frac{-}{-} = +$$

Therefore $\lim_{x\to 2^-} \frac{x-5}{x-2}$ must be $+\infty$.
Alternate form:

$$x \to 2^+ \implies x > 2 \implies x - 2 > 0 \implies \frac{x-5}{x-2} = \frac{-}{+} = -$$

Therefore $\lim_{x\to 2^+} \frac{x-5}{x-2}$ must be $-\infty$.

13b.(Source: 2.1.54-59) The function in question equals $3 - 2x$ when $x > 2$. Therefore

$$\lim_{x\to 2^+} \begin{cases} x^2 + 6 & \text{if } x < 2 \\ 3 - 2x & \text{if } 2 \le x \end{cases} = \lim_{x\to 2^+} (3 - 2x) = 3 - 4 = -1.$$

Alternate form: The function in question equals $x^2 + 5$ when $x < 2$. Therefore

$$\lim_{x\to 2^-} \begin{cases} x^2 + 5 & \text{if } x < 2 \\ 3 - 2x & \text{if } 2 \le x \end{cases} = \lim_{x\to 2^-} (x^2 + 5) = 2^2 + 5 = 9.$$

13c.(Source: 2.2.14, 2.3.15-16) $\lim_{x\to 2} \frac{x-2}{x^2-7x+10} =$ "$\frac{0}{0}$", an indeterminate form. To evaluate the limit, cancel the common factor:

$$\lim_{x\to 2} \frac{x-2}{x^2 - 7x + 10} = \lim_{x\to 2} \frac{x-2}{(x-2)(x-5)} = \lim_{x\to 2} \frac{1}{x-5} = -\frac{1}{3}.$$

Alternate form:

$$\lim_{x\to 2} \frac{x-2}{x^2 - 5x + 6} = \lim_{x\to 2} \frac{x-2}{(x-2)(x-3)} = \lim_{x\to 2} \frac{1}{x-3} = -1.$$

13d.(Source: 2.3.10,12) As $x \to -\infty$, the limit is determined entirely by the lead terms in the top and bottom:

$$\lim_{x\to -\infty} \frac{2x^2 + 9x}{3x + 4} = \lim_{x\to -\infty} \frac{2x^2}{3x} = \lim_{x\to -\infty} \frac{2x}{3} = -\infty.$$

Alternate form:

$$\lim_{x\to -\infty} \frac{2x^2 + 9x}{3x^2 + 4} = \lim_{x\to -\infty} \frac{2x^2}{3x^2} = \lim_{x\to -\infty} \frac{2}{3} = \frac{2}{3}.$$