

Piecewise-Defined Functions Homework

All work must be done on your own paper, not this handout.

For problems 1-3, evaluate each piecewise function at the given values of the independent variable.

$$1. f(x) = \begin{cases} 6x-1 & \text{if } x < 0 \\ 7x+3 & \text{if } x \geq 0 \end{cases} \quad \text{a. } f(-3) \quad \text{b. } f(0) \quad \text{c. } f(4)$$

$$2. f(x) = \begin{cases} \frac{x^2-9}{x+2} & \text{if } x \leq -1 \\ 6 & \text{if } x > -1 \end{cases} \quad \text{a. } f(-3) \quad \text{b. } f(1)$$

$$3. f(x) = \begin{cases} 2+x & \text{if } x < -4 \\ -x & \text{if } -4 \leq x \leq 2 \\ \frac{1}{3}x & \text{if } x > 2 \end{cases} \quad \text{a. } f(2) \quad \text{b. } f(3)$$

4. When a diabetic takes long-acting insulin, the insulin reaches its peak effect on the blood sugar level in about three hours. This effect remains fairly constant for 5 hours, then declines, and is very low until the next injection. In a typical patient, the level of insulin might be modeled by the following function.

$$f(t) = \begin{cases} 40t+100 & \text{if } 0 \leq t \leq 3 \\ 220 & \text{if } 3 < t \leq 8 \\ -80t+860 & \text{if } 8 < t \leq 10 \\ 60 & \text{if } 10 < t \leq 24 \end{cases}$$

Here, $f(t)$ represents the blood sugar level at time t hours after the time of the injection. If a patient takes insulin at 6 am, find the blood sugar level at each of the following times.

- a. 7 am b. 11 am c. 3 pm d. 5 pm

For problems 5-14, graph each piecewise function.

$$5. f(x) = \begin{cases} x+3 & \text{if } x < -1 \\ 2x-1 & \text{if } x \geq -1 \end{cases} \quad 6. f(x) = \begin{cases} x-1 & \text{if } x \leq 3 \\ 2 & \text{if } x > 3 \end{cases}$$

$$7. f(x) = \begin{cases} -1 & \text{if } x < 0 \\ x-3 & \text{if } x \geq 0 \end{cases} \quad 8. f(x) = \begin{cases} 4-x & \text{if } x \leq 2 \\ 3x-6 & \text{if } x > 2 \end{cases}$$

$$9. f(x) = \begin{cases} -2x & \text{if } x < -1 \\ 3x-1 & \text{if } -1 \leq x \leq 2 \\ -\frac{1}{2}x & \text{if } x > 2 \end{cases}$$

$$10. f(x) = \begin{cases} 2+x & \text{if } x < -2 \\ -x & \text{if } -2 \leq x \leq 1 \\ 0 & \text{if } x > 1 \end{cases}$$

$$11. f(x) = \begin{cases} x & \text{if } x \leq -2 \\ 2x & \text{if } x > -2 \end{cases}$$

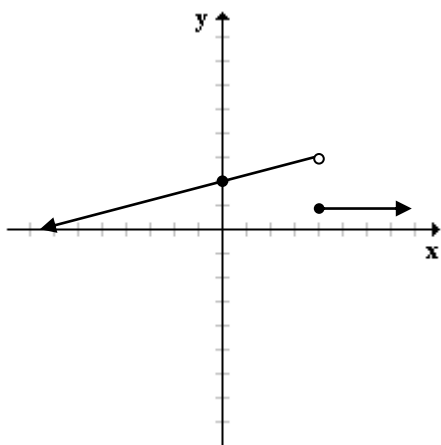
$$12. f(x) = \begin{cases} -2 & \text{if } x < 0 \\ 2 & \text{if } x > 0 \end{cases}$$

$$13. f(x) = \begin{cases} 2x+1 & \text{if } x < -1 \\ 2x+2 & \text{if } x \geq -1 \end{cases}$$

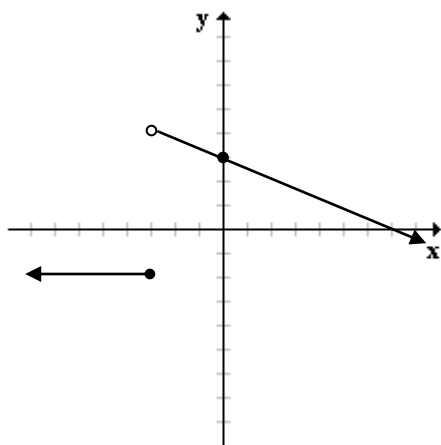
$$14. f(x) = \begin{cases} 2x-1 & \text{if } x \leq 0 \\ 2-x & \text{if } 0 < x < 3 \\ x+1 & \text{if } x \geq 3 \end{cases}$$

For problems 15-17, give the piecewise function that each graph represents.

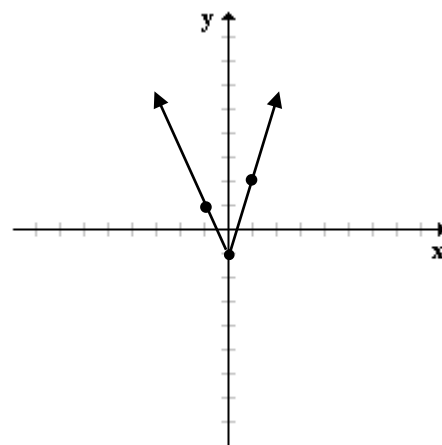
15.



16.



17.



For problems 18-21, write a piecewise function that describes each situation.

18. For a cellular phone billing plan, \$50 per month buys 400 minutes or less. Additional time costs \$0.30 per minute. Let the monthly cost $C(x)$ be a function of the time x .

19. For a cellular phone billing plan, \$60 per month buys 450 minutes or less. Additional time costs \$0.35 per minute. Let the monthly cost $C(x)$ be a function of the time x .

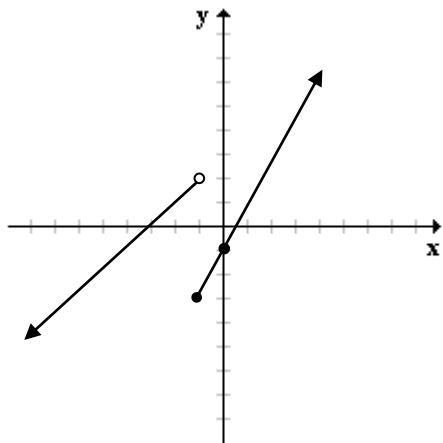
20. Income tax is 5% on the first \$50,000 of income or less, and 8% on any income in excess of \$50,000. Let the tax $T(x)$ be a function of the income x .

21. In Missouri, income tax is 3.5% on the first \$9,000 of income or less, and 6% on any income in excess of \$9,000. Let the tax $T(x)$ be a function of the income x .

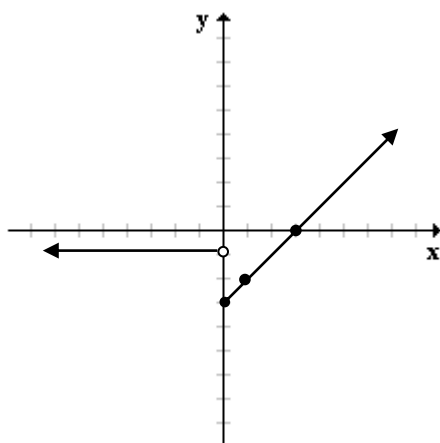
Odd Solutions – Piecewise Functions

1a. $f(-3) = -19$ 1b. $f(0) = 3$ 1c. $f(4) = 31$ 3a. $f(2) = -2$ 3b. $f(3) = 1$

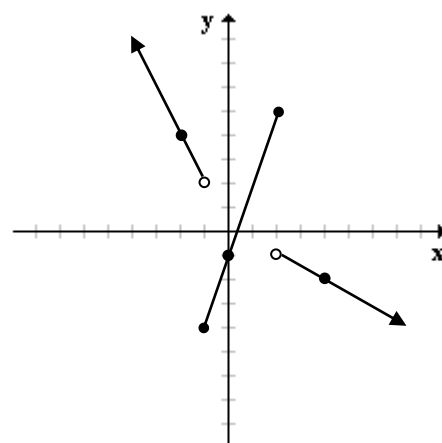
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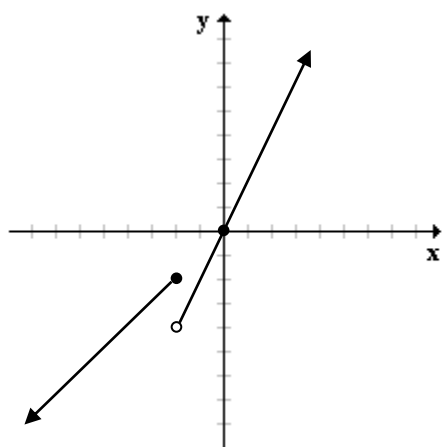
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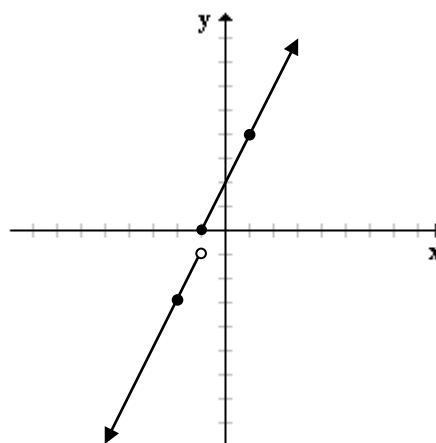
9.



11.



13.



$$15. f(x) = \begin{cases} \frac{1}{4}x + 2 & \text{if } x < 4 \\ 1 & \text{if } x \geq 4 \end{cases}$$

$$17. f(x) = \begin{cases} -2x - 1 & \text{if } x \leq 0 \\ 3x - 1 & \text{if } x > 0 \end{cases}$$

or

$$f(x) = \begin{cases} -2x - 1 & \text{if } x < 0 \\ 3x - 1 & \text{if } x \geq 0 \end{cases}$$

$$19. C(x) = \begin{cases} 60 & \text{if } 0 \leq x \leq 450 \\ 60 + 0.35(x - 450) & \text{if } x > 450 \end{cases}$$

or

$$C(x) = \begin{cases} 60 & \text{if } 0 \leq x \leq 450 \\ 0.35x - 97.5 & \text{if } x > 450 \end{cases}$$

$$21. T(x) = \begin{cases} 0.035x & \text{if } 0 \leq x \leq 9000 \\ 0.035(9000) + 0.06(x - 9000) & \text{if } x > 9000 \end{cases}$$

or

$$T(x) = \begin{cases} 0.035x & \text{if } 0 \leq x \leq 9000 \\ 0.06x - 225 & \text{if } x > 9000 \end{cases}$$