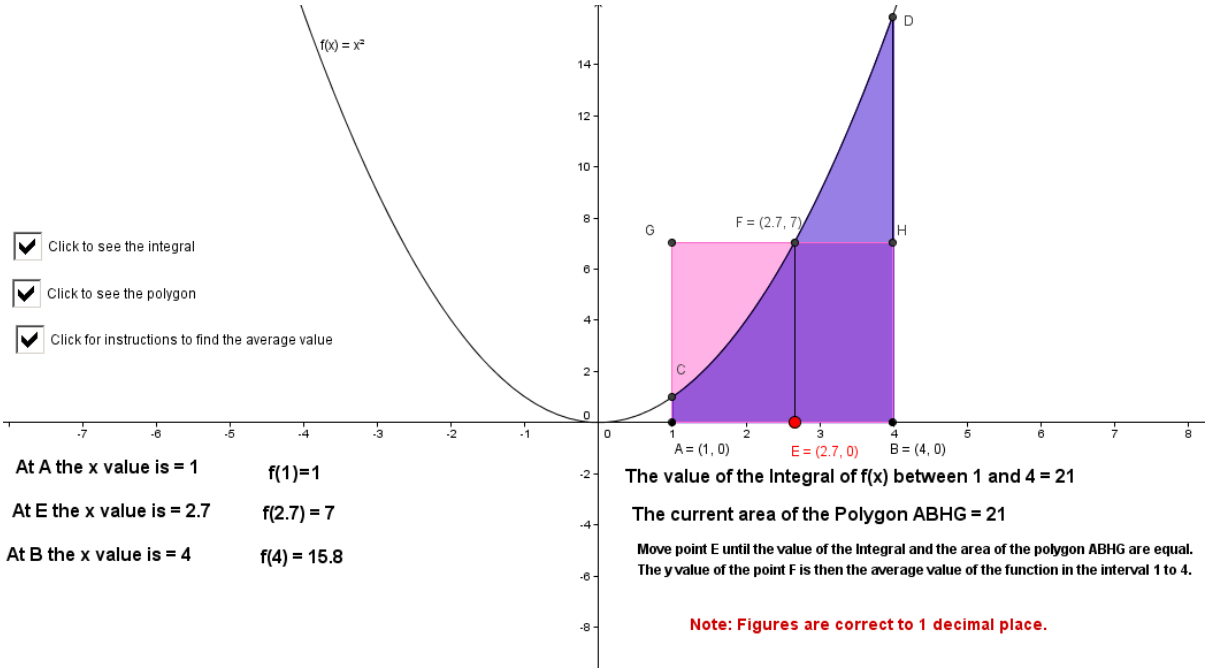
## Student Activity: To investigate the Average Value of a Function

**Use in connection with the interactive file, 'Average Value 3', on the Student's CD.**




1. Click all the boxes in the interactive file. Move the point E to (2, 0). What is the area of the polygon ABHG? Is the area between the curve $f(x) = x^2$ and the x-axis in the interval [1, 4] greater than or less than 11.9. Explain why this is the case.

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2. Move the point E in the interactive file to (2.5, 0). What is the area of the polygon ABHG now? Is the area of the curve between $f(x) = x^2$ and the x-axis in the interval [1, 4] greater than or less than 18.8. Explain why this is the case.

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3. Move the point E in the interactive file to (3, 0). What is the area of the polygon ABHG now? Is the area between the curve $f(x) = x^2$ and the x-axis in the interval [1, 4] greater than or less than 26.8. Explain why this is the case.

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4. By moving the point E in the interactive file, what is the approximate y value of the point F when the area of the polygon ABHG is equal to the area between the curve $f(x) = x^2$ and the x-axis in the interval [A, B].

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5. Using the y value of the point F from question 4 above, what is the area of the polygon ABHG in terms of a = x(A) and b = x(B) and? Where a = x(A) is the x co-ordinate of the point A and b = x(B) the x co-ordinate of the point B. Don't simplify.

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6. When the area of the polygon ABHG is equal to the area between the curve $f(x) = x^2$ and the x-axis in the interval [A, B], what is the relationship between a = x(A), b = x(B), the y value of the point F and $\int_a^b x^2 dx$ ?

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7. Considering the values f(1), f(2), f(3) and f(4), find an estimate of the average value of the function $f(x) = x^2$ in the interval [1,4]. Why is this only an estimate of the average value?

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8. Considering the values of f(1), f(1.5), f(2), f(2.5), f(3), f(3.5) and f(4), find an estimate of the average value of the function $f(x) = x^2$ in the interval [1,4]. Why is this only an estimate of the average value?

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9. Considering the values of f(1), f(1.25), f(1.5),f(1.75) f(2), f(2.25), f(2.5), f(2.75), f(3), f(3.25), f(3.5), f(3.75) and f(4), find an estimate of the average value of the function $f(x) = x^2$ in the interval [1,4]. Why is this only an estimate of the average value?

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10. Which of the above three answers do you think is the most accurate for the average value of the function $f(x) = x^2$ in the interval [1, 4]? Explain your choice.

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11. Under what circumstances would the method used in questions 7, 8 and 9 to find the average value of the function $f(x) = x^2$ give the correct answer?

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12. How many values can $x \in R$ have in the interval [1, 4]?

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13. Note: Earlier you established that the y value at the point F, the average value of the function $f(x) = x^2$ in the interval [a, b]=

$$\frac{1}{b-a}\int_a^b x^2 dx .$$

a. Hence, from the interactive file, what do you consider is the average value of the function $f(x) = x^2$ in the interval [1, 4]?

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b. Calculate $\frac{1}{4-1}\int_1^4 x^2 dx$ . Are your answers in parts a and b equal?

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a. Find the average value of the function $f(x) = x^2$ in the interval[2, 4].

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b. Would you expect the average value of the function $f(x) = x^2$ in this interval

[2, 4] used in part a to be greater than or less than the average value of the same function in the interval between [1, 4]? Explain your answer.

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15. Find the average value of the function $f(x) = 4x^2+3x+2$ in the interval [1, 3].

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16. Find the average value of the function $f(x) = 3x^2$ in the interval [-2, 2].

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17. The temperature T (in °C) recorded during a day obeyed the equation followed the curve $T = 0.001t^4 - 0.280t^2 + 25$ where t is the number of hours from noon ($-12 \leq t \leq 12$). What was the average temperature during the day? (Note: Twelve hours before and twelve hours after noon.)



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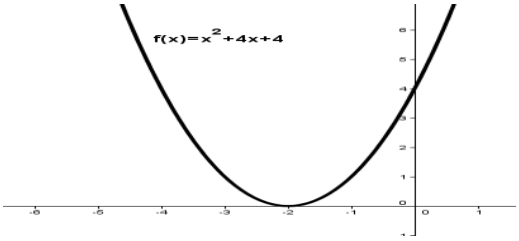
18. Find the average value of the function $f(x) = x^2 + 4x + 4$ represented in the diagram below in the interval [-4, 0].




19. Find the average value of the function $g(x) = x^3$ in the interval [0, 5].

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20. Describe, in your own words, what is meant by the average value of a function.

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21. The distance (s) travelled by a body in t seconds from rest is given by $s = 5t + 6t^2$

a. Find the average distance travelled in the first 4 seconds.

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b. Find the average distance travelled between the second and sixth second.

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Account for the difference.

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