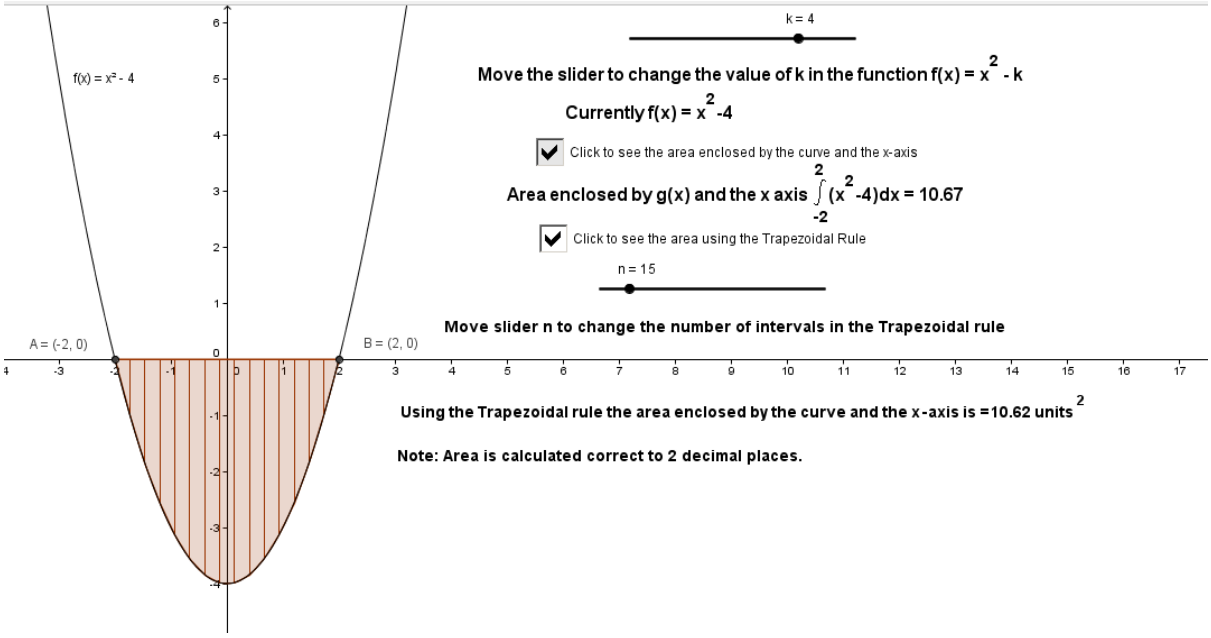
Student Activity: To investigate the relationship between integration of a function and the area enclosed by the curve that represents the function and the x-axis

Use in connection with the interactive file, 'Integration and Area 1', on the Student's CD.



Note: It is understood students will have already covered the skill of integration and understand that the integral in an interval is equal to the area enclosed by the curve representing the function and the x-axis before commencing this lesson.

1.

a. In the interactive file, find the points A and B, where the curve of the function $f(x) = x^2 - 4$ cuts the x-axis?

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b. Calculate $\int_a^b (x^2 - 4)\,dx$, where a = the x co-ordinate of the point A and b is equal to the x co-ordinate of the point B.

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c. Hence, write down is the area enclosed by the x-axis and the curve representing the function $f(x) = x^2 - 4$ in the interval [A, B]? Note: Area enclosed by the x-axis and the curve representing the function is the absolute value of the integral.

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d. Using the Trapezoidal Rule in the interactive file, what is the area enclosed by the x-axis and the curve representing the function f(x) = $x^2 - 4$ in the interval [A, B]?

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e. What is the effect of increasing the slider n?

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f. When n=100, what do you notice about the area found by integration and the area found using the Trapezoidal Rule?

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g. Use the integral of f(x) = $x^2 - 4$ to determine if the y-axis bisects the area enclosed by the x-axis and the curve of the function f(x) = $x^2 - 4$ in the interval [A, B]?

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2. Given a = −2 and b = 2, what is the difference between $\int_b^a (x^2 - 4)\,dx$ and $\int_a^b (x^2 - 4)\,dx$? ? Note changing the limits won't ALWAYS give a positive outcome, it will have the reverse effect in some instances, hence we find the absolute value of the integral

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3. Calculate $\int_{-1}^{1} (x^2 - 1)\,dx$ and hence determine the area enclosed by the curve representing the function f(x) = x^2 −1 and the x-axis in the interval [−1, 1]. Check your answer using the interactive file.

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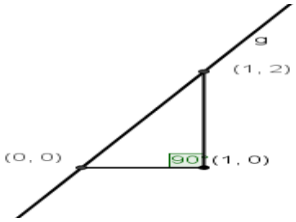
4.



a. Find the area of the triangle represented in the diagram using length of the base by the height.

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b. Find the area of the triangle shown in the diagram using co-ordinate geometry.

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c. Find the area of the triangle shown in the diagram using trigonometry.

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d. Find the equation of the line g containing the points (0, 0) and (1, 2).

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e. Find the area of the triangle shown in the diagram using $\int_0^1 g(x)dx$.

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f. What do you notice about all the solutions above?

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5.

a. Factorize $x^2 - 4x + 3$.

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b. Draw a rough sketch of the function $f(x) = x^2 - 4x + 3$.

c. Using integration, find the area enclosed by the x-axis and the curve that represents the function $f(x) = x^2 - 4x + 3$.

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6.

a. Factorize $x^2 - 4x - 5$.

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b. Where does the graph of the function $f(x) = x^2 - 4x - 5$ cross the y-axis?

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c. Draw a rough sketch of the function $f(x) = x^2 - 4x - 5$.

d. Using integration, find the area enclosed by the x-axis and the curve that represents the function $f(x) = x^2 - 4x - 5$.

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7. Given that the area enclosed by the x-axis and the curve that represents the function $f(x) = x + 4$ in the interval $[0, a]$ is 10, find possible values of a.

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