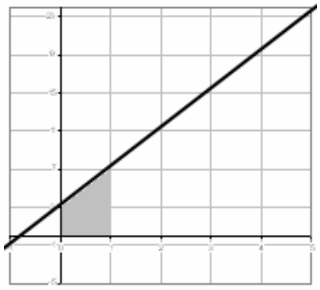
Definite Integrals & Area Between Curves

- Use integrals to determine area below a curve (between function and the x-axis).
- Use integrals to determine area between curves.

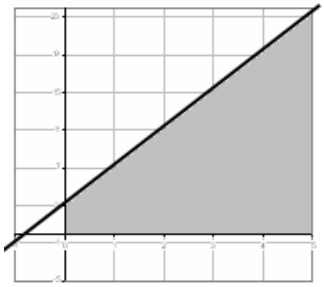
Warm up: **Given the curve** $f(x)=4x+3$

Find the area, $A=\left(\frac{b_1+b_2}{2}\right)(h)$, of the trapezoid formed between $f(x)$ and the x-axis, from

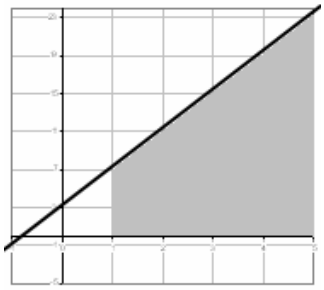
a) $x=0$ *to* $x=1$



b) $x=0$ *to* $x=5$



c) $x=1$ *to* $x=5$



Investigate:

Find the function $F(x)=\int(4x+3)dx$ and evaluate $F(5)-F(1)$.

Summary:

The area under the curve (between the curve and the x-axis) on the interval [a,b] can be represented by the Fundamental Theorem of Calculus:

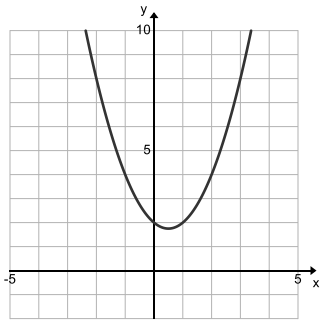
$$A=\int_a^b f(x)dx=F(x)\Big|_a^b=F(b)-F(a)$$

When we find area we are also evaluating definite integrals.

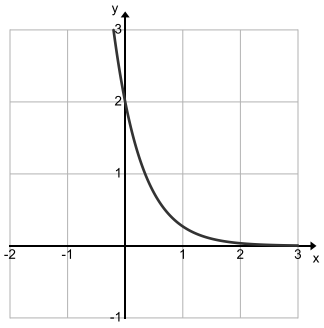
Examples – Page 455: 1kl, 2c. Page 461 : 1k

1. Find the area under the curve from *a* to *b*.

   k) $y=x^2-x+2$, from -2 to 1.

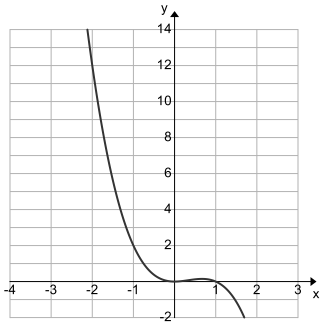


l) $y = 2e^{-2x}$, from 0 to 1.



2. Find the area below the curve and above the x-axis:

c) $y = x^2 - x^3$, from -2 to 1



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1. Sketch the region bounded by the given curves and find the area of the region.

k) $y^2 = 4x \ \ and \ \ x^2 = 4y$