

FIGURE 4

Step 2: Press **2nd** **trace** and select item **7:∫f(x)dx** (this is the integration symbol). (See Figure 4.)

At the prompt, type the lower limit **1** and enter. At the next prompt, type the upper limit **3**. The area is shaded and the decimal answer **.04398093** appears at the bottom of the screen (see Figure 5). This is an approximation to the actual value, but when using this method, the upper and lower limits must be in the range of x -values plotted on the screen.

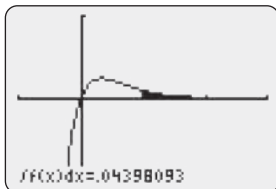


FIGURE 5

Method 2

Step 1: Press **mode** and select **CLASSIC**.

Step 2: From the home screen, press **math** and select item **9:fnInt(** (function integral). (See Figure 6.)

Type the function, the variable of integration x , the lower limit, the upper limit, a right parenthesis, and **enter**. The four items within the parentheses must be separated by commas. (**Note:** You may use any number for the upper limit; for this function 100 works well.)

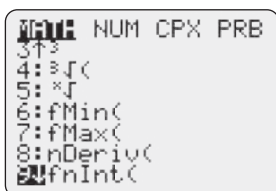


FIGURE 6

The calculator will return **.0442551719**, a more accurate answer than the result from Method 1 (see Figure 7).

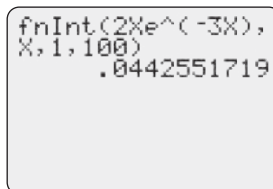


FIGURE 7

15.5 EXERCISES

💡 PRACTICE

In Exercises 1–10, find the limit if it exists.

1. $\lim_{b \rightarrow +\infty} \frac{1}{b}$

2. $\lim_{b \rightarrow +\infty} \frac{1}{\sqrt[3]{b}}$

3. $\lim_{b \rightarrow +\infty} \frac{\sqrt{b}}{20}$

4. $\lim_{b \rightarrow +\infty} e^{0.1b}$

5. $\lim_{b \rightarrow +\infty} e^{-4b}$

6. $\lim_{b \rightarrow +\infty} (-12 \ln b)$

7. $\lim_{b \rightarrow +\infty} \left(2 + \frac{9}{\sqrt{3b+1}} \right)$

8. $\lim_{b \rightarrow +\infty} (5 + e^{-2b})$

9. $\lim_{b \rightarrow +\infty} 7b^4 e^{-b}$

10. $\lim_{b \rightarrow +\infty} (7b+2)^{\frac{2}{3}}$

In Exercises 11–34, determine whether the improper integrals are convergent or divergent, and evaluate those which are convergent.

- | | | |
|---|---|---|
| 11. $\int_2^{+\infty} \frac{4}{x^3} dx$ | 12. $\int_1^{+\infty} \frac{1}{\sqrt[3]{x}} dx$ | 13. $\int_8^{+\infty} x^{-\frac{2}{3}} dx$ |
| 14. $\int_4^{+\infty} 5x^{-\frac{3}{2}} dx$ | 15. $\int_{20}^{+\infty} 3e^{-x} dx$ | 16. $\int_4^{+\infty} e^{-2x} dx$ |
| 17. $\int_2^{+\infty} e^{-\frac{x}{3}} dx$ | 18. $\int_2^{+\infty} 4e^{-0.5x} dx$ | 19. $\int_2^{+\infty} e^{1.5x} dx$ |
| 20. $\int_{-1}^{+\infty} \frac{1}{80} e^{0.16x} dx$ | 21. $\int_0^{+\infty} \frac{1}{(x+3)^2} dx$ | 22. $\int_0^{+\infty} \frac{4}{\sqrt{3x+1}} dx$ |
| 23. $\int_{-1}^{+\infty} \frac{2}{\sqrt[3]{2x+3}} dx$ | 24. $\int_2^{+\infty} (3x+2)^{-\frac{4}{3}} dx$ | 25. $\int_0^{+\infty} \frac{5}{x+1} dx$ |
| 26. $\int_0^{+\infty} (5x+4)^{\frac{3}{2}} dx$ | 27. $\int_0^{+\infty} x^2 e^{-x^3} dx$ | 28. $\int_0^{+\infty} -4xe^{x^2} dx$ |
| 29. $\int_1^{+\infty} xe^{1-x^2} dx$ | 30. $\int_0^{+\infty} 7xe^{-x^2} dx$ | 31. $\int_2^{+\infty} \frac{1}{x(\ln x)^3} dx$ |
| 32. $\int_e^{+\infty} \frac{1}{x \ln x} dx$ | 33. $\int_0^{+\infty} xe^{-x} dx$ | 34. $\int_0^{+\infty} xe^{-0.2x} dx$ |

In Exercises 35–38, find the area, if it exists, of the region under the curve $y = f(x)$ on the given interval of the x -axis.

- | | |
|--------------------------------------|----------------------------------|
| 35. $f(x) = \frac{4}{x^2}, x \geq 2$ | 36. $f(x) = 3e^{-x}, x \geq 0$ |
| 37. $f(x) = \frac{3}{x}, x \geq 6$ | 38. $f(x) = 2e^{0.8x}, x \geq 0$ |

WRITING & THINKING

39. The integral $\int_1^{\infty} \frac{1}{x^p} dx$ converges if and only if (choose all that apply):
- $0 < p < 1$
 - $p \neq 1$
 - p is an integer greater than or equal to 2
 - $p > 1$
 - p is positive
 - none of the above

TECHNOLOGY

40. Integrate $\int_1^{\infty} 2xe^{-3x} dx$ by evaluating the limit and compare your answer to the calculator values obtained at the end of the section.