Symbolab

Solution

The area between the curves $x=y^2, y=x-2$: $\frac{9}{2}$

Steps

The area between curves definition

The area between curves is the area between a curve $f(x)$ and a curve $g(x)$ on an interval $[a, b]$ given by
$A=\int_a^b |f(x)-g(x)| dx$

Isolate y for $x=y^2$: $y=\sqrt{x}, y=-\sqrt{x}$ *Show Steps*

$f_1(x)=\sqrt{x}$

$f_2(x)=-\sqrt{x}$

$f_3(x)=x-2$

If the interval is not specified find the curves intersection points.
To find the intersection points solve $f_i(x)=f_j(x)$

$\sqrt{x}=-\sqrt{x}$: $x=0$ *Hide Steps*

$\sqrt{x}=-\sqrt{x}$

Add $\sqrt{x}$ to both sides

$\sqrt{x}+\sqrt{x}=-\sqrt{x}+\sqrt{x}$

Simplify

$2\sqrt{x}=0$

Divide both sides by 2

$\frac{2\sqrt{x}}{2}=\frac{0}{2}$

Simplify

$\sqrt{x}=0$

Square both sides

$(\sqrt{x})^2=0^2$

Expand $(\sqrt{x})^2$: x *Hide Steps*

$(\sqrt{x})^2$

$\sqrt{a}=a^{\frac{1}{2}}$

$=(x^{\frac{1}{2}})^2$

Apply exponent rule: $(a^b)^c=a^{bc}$

$=x^{\frac{1}{2}\cdot 2}$

$\frac{1}{2}\cdot 2=1$ *Hide Steps*

$\frac{1}{2}\cdot 2$

Multiply fractions: $a\cdot\frac{b}{c}=\frac{a\cdot b}{c}$

$= \frac{1 \cdot 2}{2}$

Cancel the common factor: 2

$= 1$

$= x$

Expand 0^2: 0 *Hide Steps*

0^2

Apply rule $0^a = 0$

$= 0$

$x = 0$

Verify Solutions: $x = 0$ True *Hide Steps*

Check the solutions by plugging them into $\sqrt{x} = -\sqrt{x}$
Remove the ones that don't agree with the equation.

Plug $x = 0$: True *Hide Steps*

$\sqrt{0} = -\sqrt{0}$

$\sqrt{0} = 0$ *Hide Steps*

$\sqrt{0}$

Apply rule $\sqrt{0} = 0$

$= 0$

$-\sqrt{0} = 0$ *Hide Steps*

$-\sqrt{0}$

Apply rule $\sqrt{0} = 0$

$= -0$

$= 0$

$0 = 0$

True

The final solution is

$x = 0$

$\sqrt{x} = x - 2 \quad : \quad x = 4$ *Hide Steps*

$\sqrt{x} = x - 2$

Square both sides

$(\sqrt{x})^2 = (x-2)^2$

Expand $(\sqrt{x})^2$: x *Hide Steps*

$(\sqrt{x})^2$

$\sqrt{a} = a^{\frac{1}{2}}$

$= \left(x^{\frac{1}{2}}\right)^2$

Apply exponent rule: $\left(a^b\right)^c = a^{bc}$

$= x^{\frac{1}{2} \cdot 2}$

$\frac{1}{2} \cdot 2 = 1$

Hide Steps

$\frac{1}{2} \cdot 2$

Multiply fractions: $a \cdot \frac{b}{c} = \frac{a \cdot b}{c}$

$= \frac{1 \cdot 2}{2}$

Cancel the common factor: 2

$= 1$

$= x$

Expand $(x-2)^2$: $x^2 - 4x + 4$

Hide Steps

$(x-2)^2$

Apply Perfect Square Formula: $(a-b)^2 = a^2 - 2ab + b^2$

$a = x, \ b = 2$

$= x^2 - 2x \cdot 2 + 2^2$

Simplify $x^2 - 2x \cdot 2 + 2^2$: $x^2 - 4x + 4$

Hide Steps

$x^2 - 2x \cdot 2 + 2^2$

Multiply the numbers: $2 \cdot 2 = 4$

$= x^2 - 4x + 2^2$

$2^2 = 4$

$= x^2 - 4x + 4$

$= x^2 - 4x + 4$

$x = x^2 - 4x + 4$

Solve $x = x^2 - 4x + 4$: $x = 4, x = 1$

Hide Steps

$x = x^2 - 4x + 4$

Switch sides

$x^2 - 4x + 4 = x$

Subtract x from both sides

$x^2 - 4x + 4 - x = x - x$

Simplify

$x^2 - 5x + 4 = 0$

Solve with the quadratic formula

Quadratic Equation Formula:

For a quadratic equation of the form $ax^2 + bx + c = 0$ the solutions are

$x_{1,\,2} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

For $a = 1, b = -5, c = 4$: $x_{1,\,2} = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \cdot 1 \cdot 4}}{2 \cdot 1}$

Hide Steps

$x=\frac{-(-5)+\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}:\quad 4$

$\frac{-(-5)+\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

Apply rule $-(-a)=a$

$=\frac{5+\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

$5+\sqrt{(-5)^2-4\cdot 1\cdot 4}=5+\sqrt{9}$ *Hide Steps*

$5+\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$\sqrt{(-5)^2-4\cdot 1\cdot 4}=\sqrt{9}$ *Hide Steps*

$\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$(-5)^2=25$ *Hide Steps*

$(-5)^2$

Apply exponent rule: $(-a)^n=a^n$, if n is even

$(-5)^2=5^2$

$=5^2$

$5^2=25$

$=25$

$4\cdot 1\cdot 4=16$ *Hide Steps*

$4\cdot 1\cdot 4$

Multiply the numbers: $4\cdot 1\cdot 4=16$

$=16$

$=\sqrt{25-16}$

Subtract the numbers: $25-16=9$

$=\sqrt{9}$

$=5+\sqrt{9}$

$=\frac{5+\sqrt{9}}{2\cdot 1}$

Multiply the numbers: $2\cdot 1=2$

$=\frac{5+\sqrt{9}}{2}$

$\sqrt{9}=3$ *Hide Steps*

$\sqrt{9}$

Factor the number: $9=3^2$

$=\sqrt{3^2}$

Apply radical rule: $\sqrt[n]{a^n}=a$

$\sqrt{3^2}=3$

$=3$

$= \frac{5+3}{2}$

Add the numbers: $5+3=8$

$= \frac{8}{2}$

Divide the numbers: $\frac{8}{2}=4$

$=4$

$x = \frac{-(-5)-\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}: \quad 1$

Hide Steps

$\frac{-(-5)-\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

Apply rule $-(-a)=a$

$= \frac{5-\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

$5-\sqrt{(-5)^2-4\cdot 1\cdot 4} = 5-\sqrt{9}$

Hide Steps

$5-\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$\sqrt{(-5)^2-4\cdot 1\cdot 4} = \sqrt{9}$

Hide Steps

$\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$(-5)^2=25$

Show Steps

$4\cdot 1\cdot 4=16$

Show Steps

$= \sqrt{25-16}$

Subtract the numbers: $25-16=9$

$= \sqrt{9}$

$= 5-\sqrt{9}$

$= \frac{5-\sqrt{9}}{2\cdot 1}$

Multiply the numbers: $2\cdot 1=2$

$= \frac{5-\sqrt{9}}{2}$

$\sqrt{9} = 3$

Hide Steps

$\sqrt{9}$

Factor the number: $9=3^2$

$= \sqrt{3^2}$

Apply radical rule: $\sqrt[n]{a^n}=a$

$\sqrt{3^2}=3$

$=3$

$= \frac{5-3}{2}$

Subtract the numbers: $5-3=2$

$= \frac{2}{2}$

Apply rule $\frac{a}{a} = 1$

$= 1$

The final solutions to the quadratic equation are:

$x = 4, x = 1$

$x = 4, x = 1$

Verify Solutions: $x = 4$ True, $x = 1$ False

Hide Steps

Check the solutions by plugging them into $\sqrt{x} = x - 2$

Remove the ones that don't agree with the equation.

Plug $x = 4$: True

Hide Steps

$\sqrt{4} = 4 - 2$

$\sqrt{4} = 2$

Hide Steps

$\sqrt{4}$

Factor the number: $4 = 2^2$

$= \sqrt{2^2}$

Apply radical rule: $\sqrt[n]{a^n} = a$

$\sqrt{2^2} = 2$

$= 2$

$4 - 2 = 2$

Hide Steps

$4 - 2$

Subtract the numbers: $4 - 2 = 2$

$= 2$

$2 = 2$

True

Plug $x = 1$: False

Hide Steps

$\sqrt{1} = 1 - 2$

$\sqrt{1} = 1$

Hide Steps

$\sqrt{1}$

Apply rule $\sqrt{1} = 1$

$= 1$

$1 - 2 = -1$

Hide Steps

$1 - 2$

Subtract the numbers: $1 - 2 = -1$

$= -1$

$1 = -1$

False

The final solution is

$x=4$

$-\sqrt{x}=x-2\quad:\quad x=1$ Hide Steps

$-\sqrt{x}=x-2$

Square both sides

$\left(-\sqrt{x}\right)^2=(x-2)^2$

Expand $\left(-\sqrt{x}\right)^2$: $\quad x$ Hide Steps

$\left(-\sqrt{x}\right)^2$

Apply exponent rule: $\quad(-a)^n=a^n$, if n is even

$\left(-\sqrt{x}\right)^2=\left(\sqrt{x}\right)^2$

$=\left(\sqrt{x}\right)^2$

$\sqrt{a}=a^{\frac{1}{2}}$

$=\left(x^{\frac{1}{2}}\right)^2$

Apply exponent rule: $\quad\left(a^b\right)^c=a^{bc}$

$=x^{\frac{1}{2}\cdot 2}$

$\frac{1}{2}\cdot 2=1$ Hide Steps

$\frac{1}{2}\cdot 2$

Multiply fractions: $\quad a\cdot\frac{b}{c}=\frac{a\cdot b}{c}$

$=\frac{1\cdot 2}{2}$

Cancel the common factor: 2

$=1$

$=x$

Expand $(x-2)^2$: $\quad x^2-4x+4$ Hide Steps

$(x-2)^2$

Apply Perfect Square Formula: $\quad(a-b)^2=a^2-2ab+b^2$

$a=x,\ b=2$

$=x^2-2x\cdot 2+2^2$

Simplify $x^2-2x\cdot 2+2^2$: $\quad x^2-4x+4$ Hide Steps

$x^2-2x\cdot 2+2^2$

Multiply the numbers: $2\cdot 2=4$

$=x^2-4x+2^2$

$2^2=4$

$=x^2-4x+4$

$=x^2-4x+4$

$x=x^2-4x+4$

Solve $x=x^2-4x+4$: $\quad x=4, x=1$

Hide Steps

$x=x^2-4x+4$

Switch sides

$x^2-4x+4=x$

Subtract x from both sides

$x^2-4x+4-x=x-x$

Simplify

$x^2-5x+4=0$

Solve with the quadratic formula

Quadratic Equation Formula:

For a quadratic equation of the form $ax^2+bx+c=0$ the solutions are

$x_{1,\,2}=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$

For $\quad a=1, b=-5, c=4$: $\quad x_{1,\,2}=\frac{-(-5)\pm\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

$x=\frac{-(-5)+\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$: $\quad 4$

Hide Steps

$\frac{-(-5)+\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

Apply rule $-(-a)=a$

$=\frac{5+\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

$5+\sqrt{(-5)^2-4\cdot 1\cdot 4}=5+\sqrt{9}$

Hide Steps

$5+\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$\sqrt{(-5)^2-4\cdot 1\cdot 4}=\sqrt{9}$

Hide Steps

$\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$(-5)^2=25$

Hide Steps

$(-5)^2$

Apply exponent rule: $\quad (-a)^n=a^n$, if n is even

$(-5)^2=5^2$

$=5^2$

$5^2=25$

$=25$

$4\cdot 1\cdot 4=16$

Hide Steps

$4\cdot 1\cdot 4$

Multiply the numbers: $4\cdot 1\cdot 4=16$

$=16$

$=\sqrt{25-16}$

Subtract the numbers: $25-16=9$

$=\sqrt{9}$

$=5+\sqrt{9}$

$=\frac{5+\sqrt{9}}{2\cdot 1}$

Multiply the numbers: $2\cdot 1=2$

$=\frac{5+\sqrt{9}}{2}$

$\sqrt{9}=3$

Hide Steps

$\sqrt{9}$

Factor the number: $9=3^2$

$=\sqrt{3^2}$

Apply radical rule: $\sqrt[n]{a^n}=a$

$\sqrt{3^2}=3$

$=3$

$=\frac{5+3}{2}$

Add the numbers: $5+3=8$

$=\frac{8}{2}$

Divide the numbers: $\frac{8}{2}=4$

$=4$

$x=\frac{-(-5)-\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}:\quad 1$

Hide Steps

$\frac{-(-5)-\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

Apply rule $-(-a)=a$

$=\frac{5-\sqrt{(-5)^2-4\cdot 1\cdot 4}}{2\cdot 1}$

$5-\sqrt{(-5)^2-4\cdot 1\cdot 4}=5-\sqrt{9}$

Hide Steps

$5-\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$\sqrt{(-5)^2-4\cdot 1\cdot 4}=\sqrt{9}$

Hide Steps

$\sqrt{(-5)^2-4\cdot 1\cdot 4}$

$(-5)^2=25$

Hide Steps

$(-5)^2$

Apply exponent rule: $(-a)^n=a^n$, if n is even

$(-5)^2=5^2$

$=5^2$

$5^2=25$

$=25$

$4\cdot\ 1\cdot\ 4=16$ Hide Steps

$4\cdot\ 1\cdot\ 4$

Multiply the numbers: $4\cdot\ 1\cdot\ 4=16$

$=16$

$=\sqrt{25-16}$

Subtract the numbers: $25-16=9$

$=\sqrt{9}$

$=5-\sqrt{9}$

$=\frac{5-\sqrt{9}}{2\cdot\ 1}$

Multiply the numbers: $2\cdot\ 1=2$

$=\frac{5-\sqrt{9}}{2}$

$\sqrt{9}\ =3$ Hide Steps

$\sqrt{9}$

Factor the number: $9=3^2$

$=\sqrt{3^2}$

Apply radical rule: $\sqrt[n]{a^n}\ =a$

$\sqrt{3^2}\ =3$

$=3$

$=\frac{5-3}{2}$

Subtract the numbers: $5-3=2$

$=\frac{2}{2}$

Apply rule $\frac{a}{a}=1$

$=1$

The final solutions to the quadratic equation are:

$x=4, x=1$

$x=4, x=1$

Verify Solutions: $x=4$ False, $x=1$ True Hide Steps

Check the solutions by plugging them into $-\sqrt{x}\ =x-2$
Remove the ones that don't agree with the equation.

Plug $x=4$: False Hide Steps

$-\sqrt{4}\ =4-2$

$-\sqrt{4}\ =\ -2$ Hide Steps

$-\sqrt{4}$

$\sqrt{4}\ =2$ Hide Steps

$\sqrt{4}$

Factor the number: $4=2^2$

$=\sqrt{2^2}$

Apply radical rule: $\sqrt[n]{a^n}=a$

$\sqrt{2^2}=2$

$=2$

$=-2$

$4-2=2$ Hide Steps

$4-2$

Subtract the numbers: $4-2=2$

$=2$

$-2=2$

False

Plug $x=1$: True Hide Steps

$-\sqrt{1}=1-2$

$-\sqrt{1}=-1$ Hide Steps

$-\sqrt{1}$

Apply rule $\sqrt{1}=1$

$=-1$

$1-2=-1$ Hide Steps

$1-2$

Subtract the numbers: $1-2=-1$

$=-1$

$-1=-1$

True

The final solution is

$x=1$

$A=\int_0^1\left|f_1(x)-f_2(x)\right|dx+\int_1^4\left|f_1(x)-f_3(x)\right|dx$

$A=\int_0^1\left|\sqrt{x}-\left(-\sqrt{x}\right)\right|dx+\int_1^4\left|\sqrt{x}-(x-2)\right|dx$

$\int_0^1\left|\sqrt{x}-\left(-\sqrt{x}\right)\right|dx=\frac{4}{3}$ Hide Steps

$\int_0^1\left|\sqrt{x}-\left(-\sqrt{x}\right)\right|dx$

Eliminate Absolutes Hide Steps

Find the equivalent expressions to $\left|\sqrt{x}-\left(-\sqrt{x}\right)\right|$ at $0\le x\le 1$ without the absolutes

$=\int_0^1\left(\sqrt{x}-\left(-\sqrt{x}\right)\right)dx$

$=\int_0^1\left(\sqrt{x}-\left(-\sqrt{x}\right)\right)dx$

$\int_0^1\left(\sqrt{x}-\left(-\sqrt{x}\right)\right)dx=\frac{4}{3}$

Hide Steps

$\int_0^1\sqrt{x}-\left(-\sqrt{x}\right)dx$

Compute the indefinite integral: $\int\sqrt{x}-\left(-\sqrt{x}\right)dx=\frac{4}{3}x^{\frac{3}{2}}+C$

Hide Steps

$\int\sqrt{x}-\left(-\sqrt{x}\right)dx$

Refine

$=\int 2\sqrt{x}\,dx$

Take the constant out: $\int a\cdot f(x)dx=a\cdot\int f(x)dx$

$=2\cdot\int\sqrt{x}\,dx$

Apply radical rule: $\sqrt{a}=a^{\frac{1}{2}}$

$=2\cdot\int x^{\frac{1}{2}}dx$

Apply the Power Rule: $\int x^a dx=\frac{x^{a+1}}{a+1},\quad a\neq-1$

$=2\cdot\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$

Simplify $2\cdot\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$: $\frac{4}{3}x^{\frac{3}{2}}$

Hide Steps

$2\cdot\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$

$\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}=\frac{2x^{\frac{3}{2}}}{3}$

Hide Steps

$\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$

Join $\frac{1}{2}+1$: $\frac{3}{2}$

Hide Steps

$\frac{1}{2}+1$

Convert element to fraction: $1=\frac{1\cdot 2}{2}$

$=\frac{1}{2}+\frac{1\cdot 2}{2}$

Since the denominators are equal, combine the fractions: $\frac{a}{c}\pm\frac{b}{c}=\frac{a\pm b}{c}$

$=\frac{1+1\cdot 2}{2}$

$1+1\cdot 2=3$

Hide Steps

$1+1\cdot 2$

Multiply the numbers: $1\cdot 2=2$

$=1+2$

Add the numbers: $1+2=3$

$=3$

$= \frac{3}{2}$

$= \frac{x^{\frac{1}{2}+1}}{\frac{3}{2}}$

$x^{\frac{1}{2}+1} = x^{\frac{3}{2}}$ *Hide Steps*

$x^{\frac{1}{2}+1}$

Join $\frac{1}{2}+1$: $\frac{3}{2}$ *Hide Steps*

$\frac{1}{2}+1$

Convert element to fraction: $1 = \frac{1 \cdot 2}{2}$

$= \frac{1}{2} + \frac{1 \cdot 2}{2}$

Since the denominators are equal, combine the fractions: $\frac{a}{c} \pm \frac{b}{c} = \frac{a \pm b}{c}$

$= \frac{1+1 \cdot 2}{2}$

$1+1 \cdot 2 = 3$ *Hide Steps*

$1+1 \cdot 2$

Multiply the numbers: $1 \cdot 2 = 2$

$= 1+2$

Add the numbers: $1+2=3$

$=3$

$= \frac{3}{2}$

$= x^{\frac{3}{2}}$

$= \frac{x^{\frac{3}{2}}}{\frac{3}{2}}$

Apply the fraction rule: $\frac{a}{\frac{b}{c}} = \frac{a \cdot c}{b}$

$= \frac{x^{\frac{3}{2}} \cdot 2}{3}$

$= 2 \cdot \frac{2x^{\frac{3}{2}}}{3}$

Multiply fractions: $a \cdot \frac{b}{c} = \frac{a \cdot b}{c}$

$= \frac{x^{\frac{3}{2}} \cdot 2 \cdot 2}{3}$

Multiply the numbers: $2 \cdot 2 = 4$

$= \frac{4x^{\frac{3}{2}}}{3}$

$= \frac{4}{3}x^{\frac{3}{2}}$

$= \frac{4}{3}x^{\frac{3}{2}}$

Add a constant to the solution

$= \frac{4}{3}x^{\frac{3}{2}} + C$

Compute the boundaries: $\int_0^1 \left(\sqrt{x} - \left(-\sqrt{x}\right)\right)dx = \frac{4}{3} - 0$

Hide Steps

$\int_a^b f(x)dx = F(b) - F(a) = \lim_{x\to b-}\left(F(x)\right) - \lim_{x\to a+}\left(F(x)\right)$

$\lim_{x\to 0+}\left(\frac{4}{3}x^{\frac{3}{2}}\right) = 0$

Hide Steps

$\lim_{x\to 0+}\left(\frac{4}{3}x^{\frac{3}{2}}\right)$

Plug in the value $x = 0$

$= \frac{4}{3} \cdot 0^{\frac{3}{2}}$

Simplify

$= 0$

$\lim_{x\to 1-}\left(\frac{4}{3}x^{\frac{3}{2}}\right) = \frac{4}{3}$

Hide Steps

$\lim_{x\to 1-}\left(\frac{4}{3}x^{\frac{3}{2}}\right)$

Plug in the value $x = 1$

$= \frac{4}{3} \cdot 1^{\frac{3}{2}}$

Simplify

$= \frac{4}{3}$

$= \frac{4}{3} - 0$

$= \frac{4}{3} - 0$

Simplify

$= \frac{4}{3}$

$= \frac{4}{3}$

$\int_1^4 \left|\sqrt{x} - (x-2)\right|dx = \frac{19}{6}$

Hide Steps

$\int_1^4 \left|\sqrt{x} - (x-2)\right|dx$

Eliminate Absolutes

Hide Steps

Find the equivalent expressions to $\left|\sqrt{x} - (x-2)\right|$ at $1 \le x \le 4$ without the absolutes

$1 \le x \le 4:\quad \left(\sqrt{x} - (x-2)\right)$

$= \int_1^4 \left(\sqrt{x} - (x-2)\right)dx$

$= \int_1^4 \left(\sqrt{x} - (x-2)\right)dx$

$\int_1^4 \left(\sqrt{x} - (x-2)\right)dx = \frac{19}{6}$

Hide Steps

$\int_1^4 \sqrt{x} - (x-2)dx$

Compute the indefinite integral: $\int \sqrt{x} - (x-2)dx = \frac{2}{3}x^{\frac{3}{2}} - \frac{x^2}{2} + 2x + C$

Hide Steps

$\int \sqrt{x} - (x-2)dx$

Simplify

$= \int \sqrt{x} - x + 2dx$

Apply the Sum Rule: $\int f(x) \pm g(x)dx = \int f(x)dx \pm \int g(x)dx$

$= \int \sqrt{x}\, dx - \int xdx + \int 2dx$

$\int \sqrt{x}\, dx = \frac{2}{3}x^{\frac{3}{2}}$

Hide Steps

$\int \sqrt{x}\, dx$

Apply radical rule: $\sqrt{a} = a^{\frac{1}{2}}$

$= \int x^{\frac{1}{2}}dx$

Apply the Power Rule: $\int x^a dx = \frac{x^{a+1}}{a+1}, \quad a \neq -1$

$= \frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$

Simplify $\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$: $\frac{2}{3}x^{\frac{3}{2}}$

Hide Steps

$\frac{x^{\frac{1}{2}+1}}{\frac{1}{2}+1}$

Join $\frac{1}{2}+1$: $\frac{3}{2}$

Hide Steps

$\frac{1}{2}+1$

Convert element to fraction: $1 = \frac{1 \cdot 2}{2}$

$= \frac{1}{2} + \frac{1 \cdot 2}{2}$

Since the denominators are equal, combine the fractions: $\frac{a}{c} \pm \frac{b}{c} = \frac{a \pm b}{c}$

$= \frac{1 + 1 \cdot 2}{2}$

$1 + 1 \cdot 2 = 3$

Hide Steps

$1 + 1 \cdot 2$

Multiply the numbers: $1 \cdot 2 = 2$

$= 1 + 2$

Add the numbers: $1 + 2 = 3$

$= 3$

$= \frac{3}{2}$

$= \frac{x^{\frac{1}{2}+1}}{\frac{3}{2}}$

$x^{\frac{1}{2}+1} = x^{\frac{3}{2}}$

Hide Steps

$x^{\frac{1}{2}+1}$

Join $\frac{1}{2}+1$: $\frac{3}{2}$

Hide Steps

$\frac{1}{2}+1$

Convert element to fraction: $1=\frac{1\cdot 2}{2}$

$=\frac{1}{2}+\frac{1\cdot 2}{2}$

Since the denominators are equal, combine the fractions: $\frac{a}{c}\pm\frac{b}{c}=\frac{a\pm b}{c}$

$=\frac{1+1\cdot 2}{2}$

$1+1\cdot 2=3$

Hide Steps

$1+1\cdot 2$

Multiply the numbers: $1\cdot 2=2$

$=1+2$

Add the numbers: $1+2=3$

$=3$

$=\frac{3}{2}$

$=x^{\frac{3}{2}}$

$=\frac{x^{\frac{3}{2}}}{\frac{3}{2}}$

Apply the fraction rule: $\frac{a}{\frac{b}{c}}=\frac{a\cdot c}{b}$

$=\frac{x^{\frac{3}{2}}\cdot 2}{3}$

$=\frac{2}{3}x^{\frac{3}{2}}$

$=\frac{2}{3}x^{\frac{3}{2}}$

$\int xdx=\frac{x^2}{2}$

Hide Steps

$\int xdx$

Apply the Power Rule: $\int x^a dx=\frac{x^{a+1}}{a+1}, \quad a\neq -1$

$=\frac{x^{1+1}}{1+1}$

Simplify

$=\frac{x^2}{2}$

$\int 2dx=2x$

Hide Steps

$\int 2dx$

Integral of a constant: $\int adx=ax$

$=2x$

$=\frac{2}{3}x^{\frac{3}{2}}-\frac{x^2}{2}+2x$

Add a constant to the solution

$=\frac{2}{3}x^{\frac{3}{2}}-\frac{x^2}{2}+2x+C$

Compute the boundaries: $\int_1^4\left(\sqrt{x}-(x-2)\right)dx=\frac{16}{3}-\frac{13}{6}$ Hide Steps

$\int_a^b f(x)dx=F(b)-F(a)=\lim_{x\to b-}(F(x))-\lim_{x\to a+}(F(x))$

$\lim_{x\to 1+}\left(\frac{2}{3}x^{\frac{3}{2}}-\frac{x^2}{2}+2x\right)=\frac{13}{6}$ Hide Steps

$\lim_{x\to 1+}\left(\frac{2}{3}x^{\frac{3}{2}}-\frac{x^2}{2}+2x\right)$

Plug in the value $x=1$

$=\frac{2}{3}\cdot 1^{\frac{3}{2}}-\frac{1^2}{2}+2\cdot 1$

Simplify $\frac{2}{3}\cdot 1^{\frac{3}{2}}-\frac{1^2}{2}+2\cdot 1$: $\frac{13}{6}$ Hide Steps

$\frac{2}{3}\cdot 1^{\frac{3}{2}}-\frac{1^2}{2}+2\cdot 1$

Apply rule $1^a=1$

$1^{\frac{3}{2}}=1, 1^2=1$

$=1\cdot\frac{2}{3}-\frac{1}{2}+2\cdot 1$

Multiply: $\frac{2}{3}\cdot 1=\frac{2}{3}$

$=\frac{2}{3}-\frac{1}{2}+2\cdot 1$

Multiply the numbers: $2\cdot 1=2$

$=\frac{2}{3}-\frac{1}{2}+2$

Convert element to fraction: $2=\frac{2}{1}$

$=\frac{2}{1}+\frac{2}{3}-\frac{1}{2}$

Least Common Multiplier of $1, 3, 2$: 6 Hide Steps

$1, 3, 2$

Least Common Multiplier (LCM)

The LCM of a, b is the smallest positive number that is divisible by both a and b

Prime factorization of 1

Prime factorization of 3: 3 Hide Steps

3

3 is a prime number, therefore no factorization is possible

$=3$

Prime factorization of 2: 2 Show Steps

Compute a number comprised of factors that appear in at least one of the following:
$1, 3, 2$

$=3\cdot 2$

Multiply the numbers: $3 \cdot 2 = 6$

$= 6$

Adjust Fractions based on the LCM *Hide Steps*

Multiply each numerator by the same amount needed to multiply its corresponding denominator to turn it into the LCM 6

For $\frac{2}{1}$: multiply the denominator and numerator by 6

$\frac{2}{1} = \frac{2 \cdot 6}{1 \cdot 6} = \frac{12}{6}$

For $\frac{2}{3}$: multiply the denominator and numerator by 2

$\frac{2}{3} = \frac{2 \cdot 2}{3 \cdot 2} = \frac{4}{6}$

For $\frac{1}{2}$: multiply the denominator and numerator by 3

$\frac{1}{2} = \frac{1 \cdot 3}{2 \cdot 3} = \frac{3}{6}$

$= \frac{12}{6} + \frac{4}{6} - \frac{3}{6}$

Since the denominators are equal, combine the fractions: $\frac{a}{c} \pm \frac{b}{c} = \frac{a \pm b}{c}$

$= \frac{12+4-3}{6}$

Add/Subtract the numbers: $12 + 4 - 3 = 13$

$= \frac{13}{6}$

$= \frac{13}{6}$

$\lim_{x \to 4-} \left(\frac{2}{3}x^{\frac{3}{2}} - \frac{x^2}{2} + 2x\right) = \frac{16}{3}$ *Hide Steps*

$\lim_{x \to 4-} \left(\frac{2}{3}x^{\frac{3}{2}} - \frac{x^2}{2} + 2x\right)$

Plug in the value $x = 4$

$= \frac{2}{3} \cdot 4^{\frac{3}{2}} - \frac{4^2}{2} + 2 \cdot 4$

Simplify $\frac{2}{3} \cdot 4^{\frac{3}{2}} - \frac{4^2}{2} + 2 \cdot 4$: $\frac{16}{3}$ *Hide Steps*

$\frac{2}{3} \cdot 4^{\frac{3}{2}} - \frac{4^2}{2} + 2 \cdot 4$

$\frac{2}{3} \cdot 4^{\frac{3}{2}} = \frac{16}{3}$ *Hide Steps*

$\frac{2}{3} \cdot 4^{\frac{3}{2}}$

$4^{\frac{3}{2}} = 8$ *Show Steps*

$= 8 \cdot \frac{2}{3}$

Multiply fractions: $a \cdot \frac{b}{c} = \frac{a \cdot b}{c}$

$= \frac{2 \cdot 8}{3}$

Multiply the numbers: $2 \cdot 8 = 16$

$= \frac{16}{3}$

$\frac{4^2}{2} = 2^3$

Hide Steps

$\frac{4^2}{2}$

Factor 4^2: 2^4

Hide Steps

Factor $4 = 2^2$

$= (2^2)^2$

Simplify $(2^2)^2$: 2^4

Hide Steps

$(2^2)^2$

Apply exponent rule: $(a^b)^c = a^{bc}$

$= 2^{2 \cdot 2}$

Refine

$= 2^4$

$= 2^4$

$= \frac{2^4}{2}$

Cancel the common factor: 2

$= 2^3$

$2 \cdot 4 = 8$

Hide Steps

$2 \cdot 4$

Multiply the numbers: $2 \cdot 4 = 8$

$= 8$

$= \frac{16}{3} - 2^3 + 8$

Convert element to fraction: $8 = \frac{8 \cdot 3}{3}$

$= \frac{8 \cdot 3}{3} + \frac{16}{3}$

Since the denominators are equal, combine the fractions: $\frac{a}{c} \pm \frac{b}{c} = \frac{a \pm b}{c}$

$= \frac{8 \cdot 3 + 16}{3}$

$8 \cdot 3 + 16 = 40$

Hide Steps

$8 \cdot 3 + 16$

Multiply the numbers: $8 \cdot 3 = 24$

$= 24 + 16$

Add the numbers: $24 + 16 = 40$

$= 40$

$= -2^3 + \frac{40}{3}$

$2^3 = 8$

$= -8 + \frac{40}{3}$

Convert element to fraction: $8 = \frac{8 \cdot 3}{3}$

$= -\frac{8 \cdot 3}{3} + \frac{40}{3}$

Since the denominators are equal, combine the fractions: $\frac{a}{c} \pm \frac{b}{c} = \frac{a \pm b}{c}$

$= \frac{-8 \cdot 3 + 40}{3}$

$-8 \cdot 3 + 40 = 16$

Hide Steps

$-8 \cdot 3 + 40$

Multiply the numbers: $8 \cdot 3 = 24$

$= -24 + 40$

Add/Subtract the numbers: $-24 + 40 = 16$

$= 16$

$= \frac{16}{3}$

$= \frac{16}{3}$

$= \frac{16}{3} - \frac{13}{6}$

$= \frac{16}{3} - \frac{13}{6}$

Simplify

$= \frac{19}{6}$

$= \frac{19}{6}$

$A = \frac{4}{3} + \frac{19}{6}$

Simplify

$A = \frac{9}{2}$

Graph

Plotting: $x = y^2, y = x - 2$