

[>
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Math-152-512

Lab 4

[10)

[> **restart;**
> **f:=(x^8+2*x-1)/((x-1)^3*(x^2+3)^2);**
>

$$f := \frac{x^8 + 2x - 1}{(x-1)^3 (x^2+3)^2}$$

[> **fpar:=convert(f,parfrac,x);**

$$fpar := x + 3 + \frac{\frac{1}{8}}{(x-1)^3} + \frac{\frac{1}{2}}{(x-1)^2} + \frac{\frac{37}{32}}{x-1} - \frac{1}{32} \frac{309 + 37x}{x^2+3} + \frac{\frac{1}{4}(40+x)}{(x^2+3)^2}$$

[> **Int(fpar,x);value(%);**

$$\int x + 3 + \frac{\frac{1}{8}}{(x-1)^3} + \frac{\frac{1}{2}}{(x-1)^2} + \frac{\frac{37}{32}}{x-1} - \frac{1}{32} \frac{309 + 37x}{x^2+3} + \frac{\frac{1}{4}(40+x)}{(x^2+3)^2} dx$$

$$\frac{1}{2}x^2 + 3x - \frac{1}{16} \frac{1}{(x-1)^2} - \frac{1}{2} \frac{1}{x-1} + \frac{37}{32} \ln(x-1) - \frac{37}{64} \ln(x^2+3) - \frac{767}{288} \sqrt{3} \arctan\left(\frac{1}{3}x\sqrt{3}\right)$$

$$+ \frac{\frac{1}{48}(80x-6)}{x^2+3}$$

[16)

[> **with(student);**
[D, Diff, Doubleint, Int, Limit, Lineint, Product, Sum, Tripleint, changevar, completesquare,
distance, equate, integrand, intercept, intparts, leftbox, leftsum, makeproc, middlebox, middlesum,
midpoint, powsubs, rightbox, rightsum, showtangent, simpson, slope, summand, trapezoid]

[> **f:=x->sqr(8-x^3);**

[> **middlesum(f(x),x=0..2,20);m:=evalf(%);**
>

$$\frac{1}{10} \left(\sum_{i=0}^{19} \sqrt{8 - \left(\frac{1}{10}i + \frac{1}{20} \right)^3} \right)$$

```

[
    m := 4.765788807
    > middlesum(f(x), x=0..2, 40); m:=evalf(%);
        
$$\frac{1}{20} \left( \sum_{i=0}^{39} \sqrt{8 - \left( \frac{1}{20}i + \frac{1}{40} \right)^3} \right)$$

    m := 4.761514106
    > middlesum(f(x), x=0..2, 80); m:=evalf(%);
        
$$\frac{1}{40} \left( \sum_{i=0}^{79} \sqrt{8 - \left( \frac{1}{40}i + \frac{1}{80} \right)^3} \right)$$

    m := 4.759996220
    > trapezoid(f(x), x=0..2, 20); t:=evalf(%);
        
$$\frac{1}{20} \sqrt{8} + \frac{1}{10} \left( \sum_{i=1}^{19} \sqrt{8 - \frac{1}{1000} i^3} \right)$$

    t := 4.736460831
    > trapezoid(f(x), x=0..2, 40); t:=evalf(%);
        
$$\frac{1}{40} \sqrt{8} + \frac{1}{20} \left( \sum_{i=1}^{39} \sqrt{8 - \frac{1}{8000} i^3} \right)$$

    t := 4.751124819
    > trapezoid(f(x), x=0..2, 80); t:=evalf(%);
        
$$\frac{1}{80} \sqrt{8} + \frac{1}{40} \left( \sum_{i=1}^{79} \sqrt{8 - \frac{1}{64000} i^3} \right)$$

    t := 4.756319461
    > simpson(f(x), x=0..2, 20); s:=evalf(%);
        
$$\frac{1}{30} \sqrt{8} + \frac{2}{15} \left( \sum_{i=1}^{10} \sqrt{8 - \left( \frac{1}{5}i - \frac{1}{10} \right)^3} \right) + \frac{1}{15} \left( \sum_{i=1}^9 \sqrt{8 - \frac{1}{125} i^3} \right)$$

    s = 4.750232348
    > simpson(f(x), x=0..2, 40); s:=evalf(%);
        
$$\frac{1}{60} \sqrt{8} + \frac{1}{15} \left( \sum_{i=1}^{20} \sqrt{8 - \left( \frac{1}{10}i - \frac{1}{20} \right)^3} \right) + \frac{1}{30} \left( \sum_{i=1}^{19} \sqrt{8 - \frac{1}{1000} i^3} \right)$$

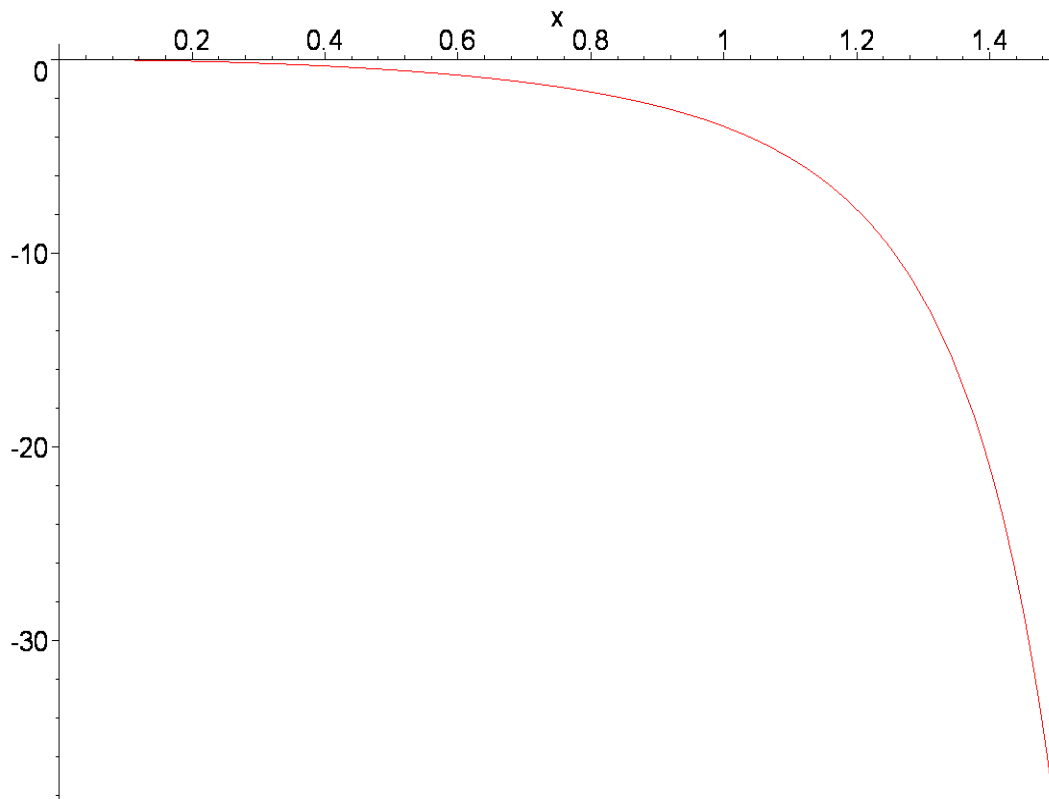
    s = 4.756012815
    > simpson(f(x), x=0..2, 80); s:=evalf(%);
        
$$\frac{1}{120} \sqrt{8} + \frac{1}{30} \left( \sum_{i=1}^{40} \sqrt{8 - \left( \frac{1}{20}i - \frac{1}{40} \right)^3} \right) + \frac{1}{60} \left( \sum_{i=1}^{39} \sqrt{8 - \frac{1}{8000} i^3} \right)$$

    s = 4.758051010

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```
> d4f:=(D@@4)(f);
```

```
> plot(d4f(x),x=0..1.5);
```



```
> K:=abs(evalf(d4f(1.5)));
```

$K := 39.38328420$

```
> error_bound:=evalf(K*(1.5)^5/(180*n^4));
```

$error_bound := 1.661482302 \frac{1}{n^4}$

```
> fsolve(error_bound=0.00001,n=0..infinity);
```

20.18942405

```
> N:=21;
```

$N := 21$

4)

```
> restart;
```

```
> with(student);
```

[D, Diff, Doubleint, Int, Limit, Lineint, Product, Sum, Tripleint, changevar, completesquare, distance, equate, integrand, intercept, intparts, leftbox, leftsum, makeproc, middlebox, middlesum, midpoint, powsubs, rightbox, rightsum, showtangent, simpson, slope, summand, trapezoid]

```
> A:=Int((ln(x))^2,x);Aparts:=intparts(A,x);value(%);
```

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>
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$$A := \int \ln(x)^2 dx$$

$$A_{parts} := \frac{1}{3} x \ln(x)^3 - \int \frac{1}{3} \ln(x)^3 dx$$

$$\ln(x)^2 x - 2 x \ln(x) + 2 x$$

5)

> **A:=Int(sqrt(x^2-4)/x,x=2..2*sqrt(2));**

$$A := \int_2^{2\sqrt{2}} \frac{\sqrt{x^2-4}}{x} dx$$

> **changevar(x=sec(theta),A,theta);Aanswer:=value(%);**

$$\int_{1/3\pi}^{\operatorname{arcsec}(2\sqrt{2})} \sqrt{\sec(\theta)^2-4} \tan(\theta) d\theta$$

$$A_{answer} := 2 - \frac{1}{2} \pi$$