APPLICATIONS OF INTEGRATION USING MATHEMATICA

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Mathematica and the Applications of Integration

- Integration is the reverse process of differentiation.
- Types of integration: Indefinite, Definite, Substitution, and By Parts.
- Integration can be used to find depreciation, the area of a region, and velocity.
- Mathematica can be used to make integration much easier.
- Problems can be solved using words or by inserting the entire equation.

Indefinite Integration

- $\int \sqrt{25-x^2}\ (-2x)dx$

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In[1]:= Integrate[Sqrt[25 - x^2] (-2 x), x]
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$$\text{Out[1]}= \frac{2}{3}\left(25 - x^2\right)^{3/2}$$

Indefinite Integration Cont.

- $\int 5x\sqrt[3]{1-x^2}\,dx$

In[4]:=
$$\int 5\,x\,\sqrt[3]{1-x^2}\;\mathrm{d}x$$

Out[4]=
$$-\frac{15}{8}\left(1-x^2\right)^{4/3}$$

Definite Integration

- $\int_{-1}^{1} x(x^2+1)^3\,dx$

$$\int_{-1}^{1} x\,(x^2+1)^3\,dx$$

Out[2]= $\frac{2}{3}\left(25-x^2\right)^{3/2}$

Out[3]= 0

Definite Integration Cont.

- $\int_1^2 2x^2 \sqrt{x^3+1}\ dx$

```
In[5]:= Integrate[2 x^2 Sqrt[x^3 + 1], {x, 1, 2}]
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$$\text{Out[5]= } 12 - \frac{8\sqrt{2}}{9}$$

Application of Integration

- The rate of depreciation dV/dt of a machine is inversely proportional to the square of t +1, where V is the value of the machine t years after it was purchased. The initial value of the machine was $500,000 and its value decreased $100,000 after the first year. Estimate its value after 4 years.
- $V=\int \uparrow \blacksquare k/\sqrt{t}+1$ dt+C where V(0)=500,000

Application of Integration Answer

$$\int \frac{k}{\sqrt{t+1}}\, dt$$

$$2k\sqrt{1+t}$$

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Solve[{2 k + C == 500000, 2 k Sqrt[2] + C == 400000}, {k, C}] // N
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{{k → -120711., C → 741421.}}
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F[t_] := 2 (-120711) Sqrt[t + 1] + 741421
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In[6]:= F[4] // N
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Out[6]= 201589.
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Question?