Yohan Lee Lab 6

## Examples

In[8]:=
```
p[x_] = Apart[(x + 5) / (x^2 + x - 2)];
Integrate[p[x], x]
```

Out[9]= $2 \operatorname{Log}[1 - x] - \operatorname{Log}[2 + x]$

In[10]:=
```
q[x_] = Apart[(x^3 + 3) / (x - 1)];
Integrate[q[x], x]
```

Out[11]= $-\frac{11}{6} + x + \frac{x^2}{2} + \frac{x^3}{3} + 4 \operatorname{Log}[-1 + x]$

In[14]:=
```
r[x_] = Apart[(x^4 - 2 x^2 + 4 x + 1) / (x^3 - x^2 - x + 1)];
Integrate[r[x], x]
```

Out[15]= $-\frac{2}{-1 + x} + \frac{1}{2}(1 + x)^2 + \operatorname{Log}[1 - x] - \operatorname{Log}[1 + x]$

In[16]:=
```
Integrate[(x^4 - 2 x^2 + 4 x + 1) / (x^3 - x^2 - x + 1), x]
```

Out[16]= $-\frac{2}{-1 + x} + \frac{1}{2}(1 + x)^2 + \operatorname{Log}[1 - x] - \operatorname{Log}[1 + x]$

In[17]:=
```
Integrate[(x^3 + 10 x^2 + 3 x + 36) / ((x - 1) (x^2 + 4)^2), x]
```

Out[17]= $-\frac{1}{8 + 2 x^2} - \frac{1}{2} \operatorname{ArcTan}\left[\frac{x}{2}\right] + 2 \operatorname{Log}[-1 + x] - \operatorname{Log}\left[4 + x^2\right]$

## Question 1

In[18]:=
```
Clear[p, q, r];
```

In[32]:=
```
p[x_] = Apart[(x^4 + 3 x^2 + 1) / (x^5 + 5 x^3 + 5 x), x]
```

Out[32]= $\frac{1}{5 x} + \frac{2 (5 x + 2 x^3)}{5 (5 + 5 x^2 + x^4)}$

In[33]:=
```
Integrate[p[x], x]
```

Out[33]= $\frac{\operatorname{Log}[x]}{5} + \frac{1}{5} \operatorname{Log}\left[5 + 5 x^2 + x^4\right]$

In[34]:=
```
q[x_] = Apart[(x^3 + 3 x^2 + 3 x - 2) / (x^2 + 2 x + 2)^2]
```

Out[34]= $\frac{-4 - x}{(2 + 2 x + x^2)^2} + \frac{1 + x}{2 + 2 x + x^2}$

In[35]:=
```
Integrate[q[x], x]
```

Out[35]= $\frac{1}{2}\left(-\frac{2 + 3 x}{2 + 2 x + x^2} - 3 \operatorname{ArcTan}[1 + x] + \operatorname{Log}\left[2 + 2 x + x^2\right]\right)$

In[36]:=
```
r[x_] = Apart[1 / (x^3 - 1)]
```

Out[36]=
$$\frac{1}{3\left(-1+x\right)}+\frac{-2-x}{3\left(1+x+x^2\right)}$$

In[37]:=
```
Integrate[r[x], x]
```

Out[37]=
$$-\frac{\text{ArcTan}\left[\frac{1+2x}{\sqrt{3}}\right]}{\sqrt{3}}+\frac{1}{3}\text{Log}\left[1-x\right]-\frac{1}{6}\text{Log}\left[1+x+x^2\right]$$

In[38]:=
```
s[x_] = Apart[1 / (x (x^2 + 4) ^2)]
```

Out[38]=
$$\frac{1}{16\,x}-\frac{x}{4\left(4+x^2\right)^2}-\frac{x}{16\left(4+x^2\right)}$$

In[39]:=
```
Integrate[s[x], x]
```

Out[39]=
$$\frac{1}{8\left(4+x^2\right)}+\frac{\text{Log}\left[x\right]}{16}-\frac{1}{32}\text{Log}\left[4+x^2\right]$$

In[40]:=
```
t[x_] = Apart[1 / (x^2 + x * Sqrt[x])]
```

Out[40]=
$$-\frac{1}{1+\sqrt{x}}+\frac{1}{x^{3/2}}-\frac{1}{x}+\frac{1}{\sqrt{x}}$$

In[41]:=
```
Integrate[t[x], x]
```

Out[41]=
$$-\frac{2}{\sqrt{x}}+2\,\text{Log}\left[1+\sqrt{x}\right]-\text{Log}\left[x\right]$$