01. (a) $\displaystyle\int 2x\,dx = x^2 + C$ (b) $\displaystyle\int \frac{1}{x}\,dx = \log x + C$

02. (a) $\displaystyle\int (2x^3 - 5x + 1)\,dx = \frac{1}{2}x^4 - \frac{5}{2}x^2 + x + C$

    (b) $\displaystyle\int (x^5 - 4x^3 + x)\,dx = \frac{1}{6}x^6 - x^4 + \frac{1}{2}x^2 + C$

03. $f(x) = \dfrac{1}{2}x^4 + \dfrac{3}{2}x^2 - x$

01. (a) $\displaystyle\int\left(x^2-\frac{1}{x^3}\right)dx=\frac{1}{3}x^3+\frac{1}{2}x^{-2}+C$ (b) $\displaystyle\int(\sqrt[3]{x}+\sqrt[4]{x})dx=\frac{3}{4}x^{\frac{4}{3}}+\frac{4}{5}x^{\frac{5}{4}}+C$

02. (a) $\displaystyle\int(\sin x-\cos x)dx=-\cos x-\sin x+C$ (b) $\displaystyle\int\frac{2\cos^2 x}{1-\sin x}dx=2x-2\cos x+C$

03. (a) $\displaystyle\int(e^x+2^{x+3})dx=e^x+\frac{2^{x+3}}{\log 2}+C$ (b) $\displaystyle\int\frac{e^{2x}-x^2}{e^x-x}dx=e^x+\frac{1}{2}x^2+C$

01. (a) $\int \dfrac{1}{(2x-1)^4}dx = -\dfrac{1}{6}(2x-1)^{-3}+C$

(b) $\int e^{7x+1}dx = \dfrac{1}{7}e^{7x+1}+C$

02. (a) $\int x(x^2+1)^3 dx = \dfrac{1}{8}(x^2+1)^4+C$

(b) $\int \sin^2 x \cos x\,dx = \dfrac{1}{3}\sin^3 x+C$

03. (a) $\int \dfrac{e^{2x}-e^{-2x}}{e^{2x}+e^{-2x}}dx = \dfrac{1}{2}\log\left|e^{2x}+e^{-2x}\right|+C$

(b) $\int \dfrac{3x^2-4}{x^3-4x+1}dx = \log\left|x^3-4x+1\right|+C$

01. 참

02. (a) $\displaystyle\int x\sin x dx = -x\cos x + \sin x + C$

(b) $\displaystyle\int x^2 \log x dx = \frac{1}{3}x^3 \log x - \frac{1}{9}x^3 + C$

03. $\displaystyle\int e^x \cos x dx = \frac{1}{2}e^x(\cos x + \sin x)$

01. 참

02. 4

03. (a) 10   (b) 0

04. $f(x) = \dfrac{1}{x} + 1,\ a = -1$

05. (a) $\dfrac{3}{2}$ (b) 1

01. 거짓

02. $e-1$

03. (a) $\dfrac{1}{6}$ (b) $\dfrac{1}{6}$

04. $25\,cm^3$

05. (a) $\dfrac{1}{7}\pi$ (b) $\dfrac{32}{5}\pi$

5장 연습문제

01.

(a) $\int (x^3 - 3x + 2)dx = \dfrac{1}{4}x^4 - \dfrac{3}{2}x^2 + 2x + C$

(b) $\int \left(e^x - \dfrac{1}{x}\right)dx = e^x - \log x + C$

(c) $\int (x+1)^2(x-2)dx = \dfrac{1}{4}x^4 - \dfrac{3}{2}x^2 - 2x + C$

(d) $\int (3^x - 1)^2 dx = \dfrac{3^{2x}}{2\log 3} - 2\dfrac{3^x}{\log 3} + x + C$

(e) $\int \sin^3 x\, dx = -\cos x + \dfrac{1}{3}\cos^3 x + C$

(f) $\int x^2 \log x\, dx = \dfrac{1}{3}x^3 \log x - \dfrac{1}{9}x^3 + C$

```
import sympy as sp
x = sp.Symbol('x')

# (a)
fx = x**3-3*x+2
print("F(x)=",sp.integrate(fx,x))

# (b)
fx = sp.exp(x)-1/x
print("F(x)=",sp.integrate(fx,x))

# (c)
fx = ((x+1)**2)*(x-2)
print("F(x)=",sp.integrate(fx,x))

# (d)
fx = (3**x-1)**2
print("F(x)=",sp.integrate(fx,x))

# (e)
fx = (sp.sin(x))**3
print("F(x)=",sp.integrate(fx,x))
```

```
# (f)
fx = (x**2)*sp.log(x)
print("F(x)=",sp.integrate(fx,x))
```

02. $f(-1)=4e^{-1}+1$

03. $f(x)=-4x^3+3x^2+5$

04. (a) $\displaystyle\int \frac{1}{x(x+1)}dx=\log\left|\frac{x}{x+1}\right|+C$

    (b) $\displaystyle\int \frac{2x-3}{x^2-3x+2}dx=\log\left|x^2-3x+2\right|+C$

```
import sympy as sp
x = sp.Symbol('x')

# (a)
fx = 1/(x*(x+1))
print("F(x)=",sp.integrate(fx,x))

# (b)
fx = (2*x-3)/(x**2-3*x+2)
print("F(x)=",sp.integrate(fx,x))
```

05. $f(x)=\dfrac{1}{3}(-\cos x+\sin x)+\dfrac{2}{3}$, $g(x)=\dfrac{1}{3}(-2\cos x-\sin x)+\dfrac{1}{3}$

06. (a) e^2-3 (b) 4 (c) $\dfrac{1}{3}(11\sqrt{11}-3\sqrt{3})$ (d) $\dfrac{1}{2}(e^{\frac{\pi}{2}}+1)$

```
import sympy as sp
x = sp.Symbol('x')

# (a)
fx = (sp.exp(2*x)-1)/(sp.exp(x)+1)
print("The answer is ",sp.integrate(fx,(x,0,2)))
```

```
# (b)
fx = sp.Abs(sp.sin(x))
print("The answer is ",sp.integrate(fx,(x,-sp.pi,sp.pi)))

# (c)
fx = x*sp.sqrt(x**2+2)
print("The answer is ",sp.integrate(fx,(x,1,3)))

# (d)
fx = sp.exp(x)*sp.sin(x)
print("The answer is ",sp.integrate(fx,(x,0,sp.pi/2)))
```

07. $f(5) = 30$

08. $\lim_{h \to 0} \dfrac{1}{h} \displaystyle\int_{2}^{2+h} f(t)dt = f(2) = e^4 + 4\log 2$

09. $M + m = 12$

10. 생략

11. 생략

```
import sympy as sp

x = sp.Symbol('x')
a = sp.Symbol('a')
alpha = sp.Symbol('alpha')
beta  = sp.Symbol('beta')

fx = a*(x-alpha)*(x-beta)
print("The answer is ", sp.factor(sp.integrate(fx,(x,alpha,beta))))
```

12. (a), (b) 생략   (c) 0

13. $\dfrac{\pi}{4}$

```
import sympy as sp

x = sp.Symbol('x')

fx = sp.sqrt(1-x**2)
print("The answer is ", sp.integrate(fx,(x,0,1)))
```

14. $\dfrac{12}{7}$

15. (a) 2 (b) $e - e^{-2} + 6$

16. $\dfrac{1}{2}e^2 - \dfrac{1}{2}$

17. $a = \dfrac{1}{4}$

18. (a) $\dfrac{3}{2}e^2 - e^{-1} + \dfrac{1}{2}e^{-4} - 1$ (b) $\dfrac{1}{6}$

19. $4\pi^2$