

CHAPTER 09 매개변수 방정식과 벡터

SECTION 9.1 매개변수 곡선

유제 9-1

타원

유제 9-2

$$\frac{dy}{dx} = \frac{8}{3t+2}$$

유제 9-3

$$y = -\frac{1}{2}x + \sqrt{2}$$

유제 9-4

$$\frac{2}{3}$$

9.1 연습문제

01

$$x^2 + y^2 = 1$$

02

$$y = \frac{1}{2}e^x - 1$$

03

$$\left(\frac{x}{a}\right)^2 + \left(\frac{y}{b}\right)^2 = 1$$

04

$$x = 2\cos t, \quad y = \sin t$$

05

$$x = 2\sqrt{2}\cos\theta + \frac{1}{2}, \quad y = 2\sin\theta + \frac{3}{2}$$

06

$$x = 4\sec\theta, \quad y = 2\tan\theta$$

07

$$\frac{dy}{dx} = \frac{2t\cos t - t^2\sin t}{\sin t + t\cos t}$$

$$\frac{d^2y}{dx^2} = \frac{2\cos t \sin t + t(-4 + 2\cos^2 t) - t^2\cos t \sin t - t^3}{(\sin t + t\cos t)^3}$$

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08

$$\frac{dx}{dt} = \frac{2t+3}{2e^{2t}}, \quad \frac{d^2y}{dx^2} = \frac{-t-1}{e^{4t}}$$

09

$$\frac{dy}{dx} = \frac{3t}{2\ln t + 1}, \quad \frac{d^2y}{dx^2} = \frac{6\ln t - 3}{t(2\ln t + 1)^3}$$

10

$$y = -\frac{3}{2}x + 7$$

11

$$y = \frac{\sqrt{3}}{3}x + 2 - \sqrt{3}$$

12

$$ab\pi$$

13

$$\frac{1}{27}(40^{3/2} - 13^{3/2})$$

14

$$2\pi$$

15

$$\sqrt{2}(1 - e^{-\frac{\pi}{2}})$$

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SECTION 9.2 극좌표

유제 9-5

(a) $A(1, \sqrt{3})$

(b) $B(2, 2\sqrt{3})$

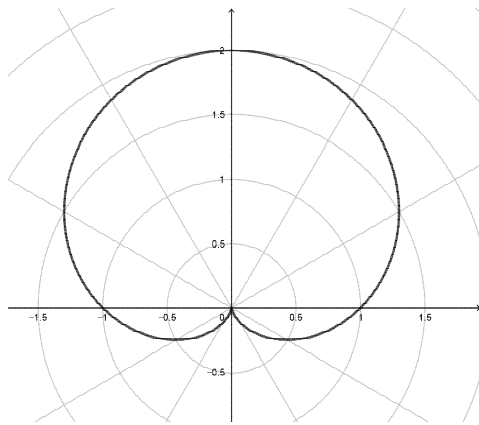
유제 9-6

$D\left(5, \tan^{-1} \frac{3}{4}\right)$

유제 9-7

$\overline{AB} = \sqrt{29 - 10\sqrt{2}}$

유제 9-8



유제 9-9

$\sqrt{3}$

유제 9-10

$\frac{9\pi}{2}$

유제 9-11

12π

유제 9-12

$2\sqrt{2}$

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9.2 연습문제

01

$$A(\sqrt{3}, 1)$$

02

$$B\left(-\frac{3\sqrt{3}}{2}, -\frac{3}{2}\right)$$

03

$$C(1, -\sqrt{3})$$

04

$$A\left(\sqrt{2}, \frac{\pi}{4}\right)$$

05

$$B\left(\sqrt{6}, -\frac{\pi}{4}\right)$$

06

$$C\left(3, \tan^{-1}\left(\frac{2}{\sqrt{5}}\right)\right)$$

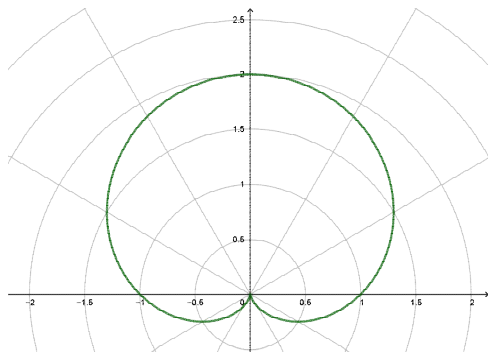
07

$$\sqrt{8+4\sqrt{3}}$$

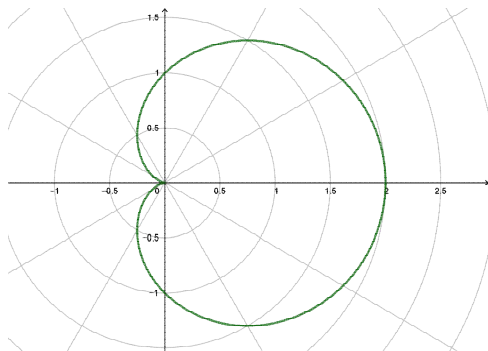
08

$$\sqrt{8-4\sqrt{3}}$$

09

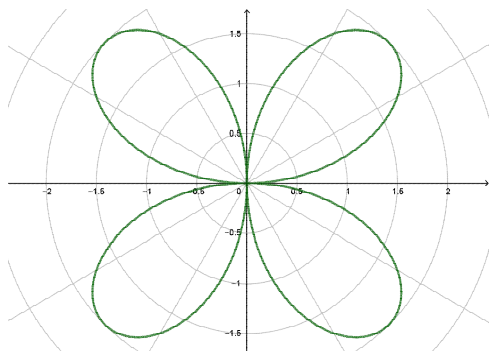


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11



(2021-10-08 : 3.5절 연습문제 12~15를 9.2절 연습문제 12~15로 이동하였습니다)

12

$$G(r, \theta) = 2r^4 - 25 \cdot r^2 \cdot \cos(2\theta) = 0$$

13

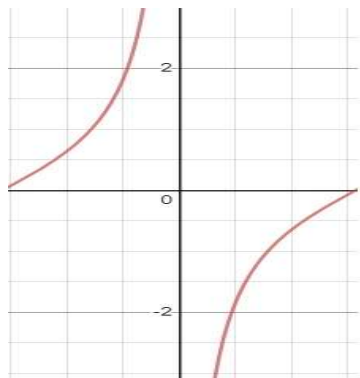
$$\frac{dr}{d\theta} = \frac{-25r \sin(2\theta)}{4r^2 - 25 \cos(2\theta)}$$

14

$$y = \frac{-1}{\tan\left(\frac{\pi}{8}\right)} \left(x - r \cos\left(\frac{\pi}{8}\right) \right) + r \sin\left(\frac{\pi}{8}\right)$$

15

접선의 기울기를 나타내는 그래프는 다음과 같다.



16

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

17

$$0$$

18

$$\frac{5\sqrt{3}}{3}$$

19

$$\pi$$

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20

11π

21

24π

22

4π

23

$\frac{\pi}{8} - \frac{1}{4}$

24

$\frac{\sqrt{3}}{2} - \frac{2\pi}{3}$

25

$\frac{4\pi}{3}$

26

$2\sqrt{3} + \frac{2\pi}{3}$

27

4π

28

3π

29

16

30

4π

31

$$L = \int_0^\pi \sqrt{(2 + \cos 2\theta)^2 + 4\sin^2 2\theta} \, d\theta$$

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SECTION 9.3 행렬과 행렬식

유제 9-13

(a) $\begin{pmatrix} 1 & 4 & -9 \\ -5 & -9 & -2 \\ -1 & -3 & -12 \end{pmatrix}$

(b) $\begin{pmatrix} -3 & 6 & -15 \\ -9 & -12 & -6 \\ -3 & -6 & -18 \end{pmatrix}$

(c) $\begin{pmatrix} 9 & -6 & 17 \\ 11 & 10 & 10 \\ 5 & 8 & 18 \end{pmatrix}$

유제 9-14

$$\begin{pmatrix} 4 & -4 & 21 \\ 0 & -2 & 15 \\ 4 & 2 & 7 \end{pmatrix}$$

유제 9-15

$$A^{-1} = \begin{pmatrix} 1 & -2 \\ -1 & 3 \end{pmatrix}$$

유제 9-16

(a) $\det(A) = 0$

(b) $\det(B) = 11$

9.3 연습문제

01

$$a = 5, \quad b = 1$$

02

$$a = 2, \quad b = 0, \quad c = 3, \quad d = 1$$

03

$$\begin{pmatrix} 2 & 4 & -2 \\ 6 & 2 & 10 \\ -2 & 6 & 8 \end{pmatrix}$$

04

$$\begin{pmatrix} -4 & 4 & -8 \\ -2 & -6 & -12 \\ -4 & 8 & -10 \end{pmatrix}$$

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05

$$\begin{pmatrix} 7 & -4 & 11 \\ 6 & 10 & 23 \\ 5 & -9 & 19 \end{pmatrix}$$

06

$$\begin{pmatrix} 2 & 8 & 11 \\ 17 & -23 & 43 \\ 9 & -5 & 34 \end{pmatrix}$$

07

$$a=7, \quad b=-4, \quad c=2$$

08

$$a=3, \quad b=5, \quad c=-2$$

09

$$\begin{pmatrix} 2 & 3 & 1 \\ 1 & -2 & 3 \\ 0 & 3 & -2 \end{pmatrix} \begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix} = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix}$$

10

$$\begin{pmatrix} 3 & 4 & 1 \\ 4 & 0 & 3 \\ -1 & 5 & 2 \end{pmatrix} \begin{pmatrix} x_1 \\ y_1 \\ z_1 \end{pmatrix} = \begin{pmatrix} 2 \\ 1 \\ 5 \end{pmatrix}$$

11

$$-13$$

12

$$-1$$

13

$$0$$

14

$$35$$

15

$$a^2 + b^2$$

16

$$-4ab$$

17

$$c^2 + b^2 + a^2 - bc - ac - ab$$

18

$$b(1-c) + a(1-d)$$

19

$$\lambda = -4 \quad \text{또는} \quad \lambda = -2$$

20

$$\lambda = 0 \quad \text{또는} \quad \lambda = 4$$

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21

$$\lambda = 4 \text{ 또는 } 1 \pm \sqrt{2}$$

22

$$\lambda = 0$$

23

$$k = \frac{3 \pm \sqrt{33}}{4}$$

24

$$A^{-1} = -\frac{1}{23} \begin{pmatrix} -5 & -2 \\ -4 & 3 \end{pmatrix}$$

25

$$A^{-1} = \frac{1}{2} \begin{pmatrix} 4 & -2 \\ -3 & 2 \end{pmatrix}$$

26

증명 생략

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SECTION 9.4 벡터

유제 9-17

$$\overrightarrow{PQ} = (8, -5, 2)$$

유제 9-18

$$2u + v = (7, 10, 1)$$

$$u - 3v = (0, -2, -3)$$

$$\|u\| = 5$$

유제 9-19

$$\frac{1}{3\sqrt{2}}(1, 4, -1)$$

유제 9-20

$$6$$

유제 9-21

$$2$$

유제 9-22

증명 생략

유제 9-23

$$2i + 5j + k$$

유제 9-24

$$\frac{\sqrt{33}}{2}$$

유제 9-25

$$(-2, -8, -2)$$

유제 9-26

$$-6$$

유제 9-27

증명 생략

9.4 연습문제

01

$$u + v = (3, 1)$$

$$2u + 3v = (8, 1)$$

$$u - 3v = (-5, 5)$$

$$\|u\| = \sqrt{5}$$

02

$$u + v = 6i - 2j$$

$$2u + 3v = 14i - 7j$$

$$u - 3v = -2i + 10j$$

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$$\|u\| = \sqrt{17}$$

03

$$u + v = (-1, 0, 5)$$

$$2u + 3v = (-1, -1, 12)$$

$$u - 3v = (-5, 4, -3)$$

$$\|u\| = \sqrt{14}$$

04

$$u + v = i + 4j + 2k$$

$$2u + 3v = 5i + 12j + 3k$$

$$u - 3v = -11i - 12j + 6k$$

$$\|u\| = \sqrt{13}$$

05

$$\frac{1}{\sqrt{6}}(2i + j - k)$$

06

$$\frac{1}{\sqrt{14}}(-i + 2j + 3k)$$

07

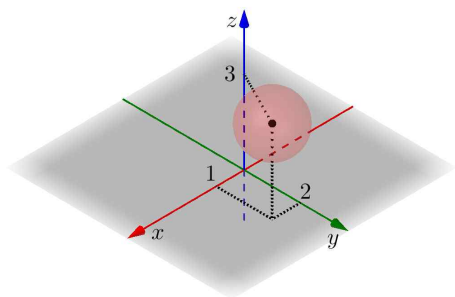
$$\theta = \frac{\pi}{6}$$

08

$$k = \pm \frac{3\sqrt{6}}{2}$$

09

$$(x-1)^2 + (y-2)^2 + (z-3)^2 = 1$$



10

$$-1$$

11

$$1$$

12

$$3$$

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13

− 8

14

(3, − 5, 4)

15

(− 11, 3, 10)

16

− i

17

(0, 0, 0)

18

2k

19

(0, 1, − 1)

20

(11, 7, 1)

21

(4, − 6, 5)

22

(3, 15, − 6)

23

$\frac{3}{2} \sqrt{30}$

24

7

25

4

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SECTION 9.5 직선과 평면의 방정식

유제 9-28

$$x = 3t + 3, \quad y = -2t + 2, \quad z = 5t + 1$$

유제 9-29

$$\frac{x-3}{-1} = \frac{y-6}{2} = \frac{z-1}{4}$$

유제 9-30

$$\frac{x-1}{-2} = \frac{y+5}{3} = \frac{z-4}{-1}$$

유제 9-31

$$\frac{2\sqrt{51}}{\sqrt{22}}$$

유제 9-32

$$2x + 4y + 6z - 4 = 0$$

유제 9-33

$$2x - y + z - 2 = 0$$

유제 9-34

$$\cos \theta = 0$$

유제 9-35

$$D = \frac{7\sqrt{30}}{15}$$

9.5 연습문제

01

$$x = 2t + 1, \quad y = 3t - 2, \quad z = t + 3$$

02

$$x = t + 3, \quad y = 4t + 1, \quad z = -t - 4$$

03

$$\frac{x+1}{3} = \frac{y-2}{4} = \frac{z-7}{5}$$

04

$$\frac{x+1}{3} = \frac{y-5}{-2} = \frac{z-3}{5}$$

05

$$x - 2 = y - 3 = \frac{z - 1}{-2}$$

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06

벡터 방정식 : $r = (3, -5, 1) + t(-2, 7, -2)$

매개변수 방정식 : $x = -2t + 3, y = 7t - 5, z = -2t + 1$

07

벡터 방정식 : $r = (4, -5, -2) + t(-1, 7, 3)$

매개변수 방정식 : $x = -t + 4, y = 7t - 5, z = 3t - 2$

08

$$\frac{\sqrt{170}}{3}$$

09

$$\therefore \left(-6 + 3\sqrt{61}, \frac{-9 + 3\sqrt{61}}{2}, \frac{-17 + 3\sqrt{61}}{2} \right) \text{ 또는 } \left(-6 - 3\sqrt{61}, \frac{-9 - 3\sqrt{61}}{2}, \frac{-17 - 3\sqrt{61}}{2} \right)$$

10

$$\frac{1}{2\sqrt{13}}(4, 5, -1)$$

11

$$\cos \theta = \frac{3\sqrt{14}}{14}$$

12

$$\cos \theta = \frac{11\sqrt{105}}{210}$$

13

$$\frac{7\sqrt{6}}{\sqrt{59}}$$

14

$$\frac{\sqrt{373}}{\sqrt{46}}$$

15

$$2x + y - z - 5 = 0$$

16

$$4x - 2y + 5z - 10 = 0$$

17

$$9x - 23y + 9z - 104 = 0$$

18

$$18x + 4y + 13z - 33 = 0$$

19

$$\cos \theta = -\frac{\sqrt{42}}{21}$$

20

$$D = \frac{2\sqrt{2}}{3}$$

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21

$$D = \frac{11\sqrt{26}}{26}$$