Problem 1

What is the length of a line segment with a slope of 4/3, measured from the y-axis to a point (6,4)?

A. 10
B. 25
C. 50
D. 75

Problem 1

What is the length of a line segment with a slope of 4/3, measured from the y-axis to a point (6,4)?

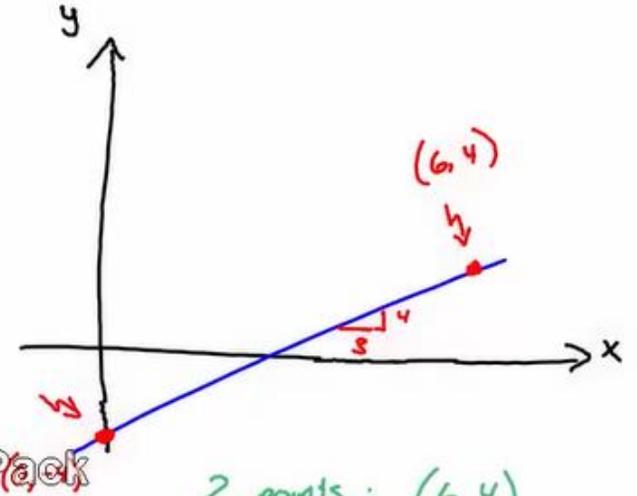A. 10

B. 25

C. 50

D. 75

Page 35

– point-slope form:

$$m = \frac{4}{3}, \quad (6, 4)$$

$$y - y_1 = m(x - x_1)$$

$$y - 4 = \frac{4}{3}(x - 6)$$

$$y - 4 = \frac{4}{3}x - 8$$

$$y = \frac{4}{3}x - 4$$

$(6, 4)$

2 points: $(6, 4)$
$(0, -4)$

$$\therefore d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} = \sqrt{(6-0)^2 + [4-(-4)]^2} = \sqrt{6^2 + 8^2} = \sqrt{36 + 64}$$

$$= \sqrt{100}$$

$$= 10$$

Problem 2

What is the general form of the
equation for a line whose x-intercept is
4 and y-intercept is -6?

A. $2x - 3y - 18 = 0$

B. $2x + 3y + 18 = 0$

C. $3x - 2y - 12 = 0$

D. $3x + 2y + 12 = 0$

Problem 2

What is the general form of the equation for a line whose x-intercept is 4 and y-intercept is -6?

2 points: $(4,0)$ & $(0,-6)$

$\therefore m = \dfrac{\Delta y}{\Delta x} = \dfrac{-6-0}{0-4} = \dfrac{-6}{-4} = \dfrac{3}{2}$

$b = $ y-intercept $= -6$

A. $2x - 3y - 18 = 0$

B. $2x + 3y + 18 = 0$

C. $3x - 2y - 12 = 0$

D. $3x + 2y + 12 = 0$

$y = \dfrac{3}{2}x$

$2y = 3x - 12$

$0 = 3x - 2y - 12$

Problem 3

Simplify and evaluate the following expression.

$$\log_3\left(\frac{3}{2}\right) + \log_3(12) - \log_3(2)$$

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A. 0.95

B. 1.33

C. 2.00

D. 2.20

Problem 3

Simplify and evaluate the following expression.

$$\log_3\left(\frac{3}{2}\right) + \log_3(12) - \log_3(2)$$

$$\log_3\left(\frac{3}{2}\right) + \log_3(6)$$

A. 0.95
B. 1.33
C. 2.00
D. 2.20

$$\log_3\left(\frac{3}{2} \cdot 6\right)$$

$$\log_3 9 = \frac{\ln 9}{\ln 3}$$

$$\log_3(9) = x$$

$$3^x = 9$$

Problem 4

For some angle θ, csc(θ) = -8/5.
What is cos(2θ)?

    A. 7/32
    B. 1/4
    C. 3/8
    D. 5/8

Problem 4

For some angle θ, csc(θ) = -8/5.
What is cos(2θ)?

$$\csc(\theta) = \frac{-8}{5}$$

$$\cos 2\alpha = 1 - 2\sin^2\alpha$$

$$\therefore \quad \sin\theta = \frac{-5}{8}$$

A. 7/32

$$\cos(2\theta) = ?$$

B. 1/4

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C. 3/8

D. 5/8

$$\therefore \quad \cos(2\theta) = 1 - 2\sin^2(\theta)$$

$$= 1 - 2\left(\frac{-5}{8}\right)^2$$

$$= 1 - 2\left(\frac{25}{64}\right)$$

$$= 1 - \frac{25}{32} = \frac{7}{32}$$

Problem 5

The expression...

$$\csc(x)\cos^3(x)\tan(x)$$

... is equivalent to which of the
following?

A. sin(x)

B. cos(x)

C. $1 - \sin^2(x)$

D. $1 + \sin^2(x)$

Problem 5

The expression...

$$\csc(x)\cos^3(x)\tan(x)$$

$$\left(\frac{1}{\cancel{\sin(x)}}\right)\left(\frac{\cos^3(x)}{1}\right)\left(\frac{\cancel{\sin(x)}}{\cos(x)}\right)$$

$$\cos^2(x)$$

... is equivalent to which of the following?

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$$\sin^2(x) + \cos^2(x) = 1$$

$$\therefore \boxed{\cos^2(x) = 1 - \sin^2(x)}$$

A. sin(x)

B. cos(x)

C. $1 - \sin^2(x)$

D. $1 + \sin^2(x)$

Problem 6

What is the value of x (less than 360°)
that will satisfy the following equation?

$$\sin^2(x) + 4\sin(x) + 3 = 0$$

A. 45°

B. 90°

C. 180°

D. 270°

Problem 6

What is the value of x (less than 360°) that will satisfy the following equation?
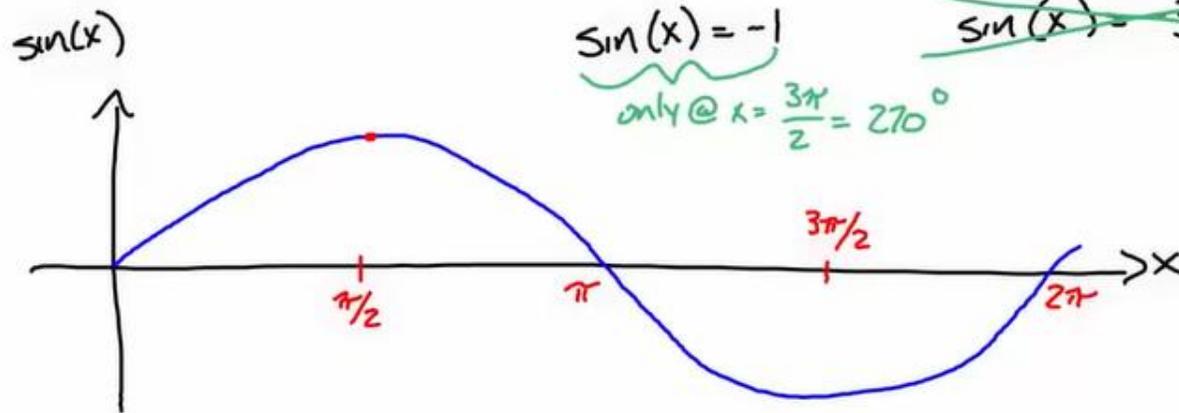
$$\sin^2(x) + 4\sin(x) + 3 = 0$$

A. 45°
B. 90°
C. 180°
D. 270°

Let $u = \sin(x)$

$$u^2 + 4u + 3 = 0$$
$$(u+1)(u+3) = 0$$

$u = -1$ $u = -3$

$\sin(x) = -1$ $\sin(x) = -3$ INVALID

only @ $x = \frac{3\pi}{2} = 270°$

$\sin(x)$

$\frac{\pi}{2}$ π $\frac{3\pi}{2}$ 2π

$\rightarrow x$

Problem 7

If the rectangular coordinates of a point are (-3, -5.2), what are its polar coordinates?

    A. (-6, -120°)

    B. (6, -120°)

    C. (6, 120°)

    D. (6, -150°)

Problem 7

If the rectangular coordinates of a point are (-3, -5.2), what are its polar coordinates?

A. (-6, -120°)
B. (6, -120°)
C. (6, 120°)
D. (6, -150°)

$$r = \sqrt{3^2 + (5.2)^2}$$
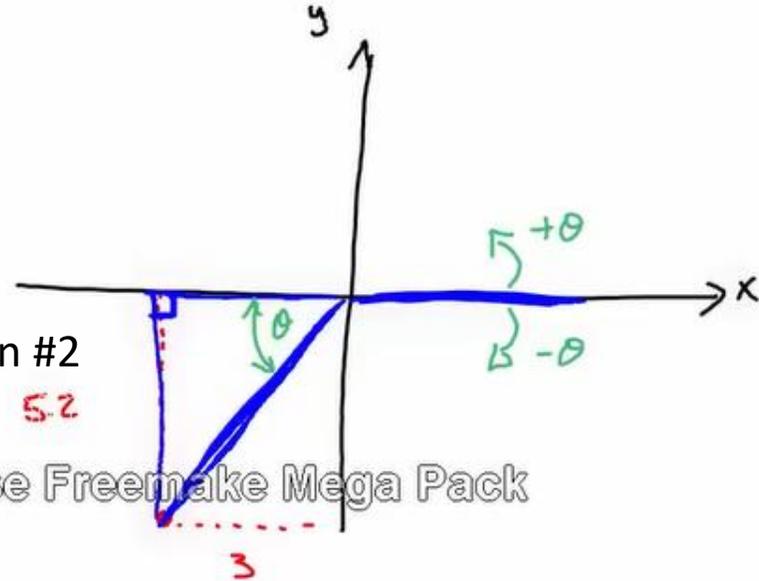
Page 36 - Eqn #2

$$\tan \theta = \frac{5.2}{3}$$

$$\therefore \theta = \tan^{-1}\left(\frac{5.2}{3}\right) = 60°$$

Page 36 - Eqn #1

Problem 8

Determine the (x, y) coordinates of the center of the circle defined by the following equation?

$$x^2 - 8x + y^2 - 10y + 25 = 0$$

A. (3, 2)

B. (3, 4)

C. (4, 5)

D. (5, 4)

Problem 8

Determine the (x, y) coordinates of the center of the circle defined by the following equation?

$(x-h)^2 + (y-k)^2 = r^2$

$$x^2 - 8x + y^2 - 10y + 25 = 0$$

$$(x^2 - 8x + 16) + (y^2 - 10y + 25) = -25 + 16 + 25$$

$$x^2 - 8x + y^2 - 10y + 25 = 0$$

$$(x-4)^2 + (y-5)^2 = 16$$

$$(4, 5)$$

A. (3, 2)

B. (3, 4)

C. (4, 5)

D. (5, 4)

Problem 9

What is the slope of the following curve when it crosses the positive part of the x-axis?

$$y = 10x^2 - 3x - 1$$

A. 3/20
B. 1/5
C. 1/3
D. 7

Problem 9

What is the slope of the following curve when it crosses the positive part of the x-axis?

$$y = 10x^2 - 3x - 1$$

A. 3/20
B. 1/5
C. 1/3
D. 7

$$\frac{dy}{dx} = 20x - 3$$

$$\left.\frac{dy}{dx}\right|_{x=\frac{1}{2}} = 20\left(\frac{1}{2}\right) - 3$$
$$= 10 - 3$$
$$= 7$$

$$0 = 10x^2 - 3x - 1 \quad \text{Roots of the Quadratic Eqn - Page 35}$$

$$\therefore x = \frac{3 \pm \sqrt{(-3)^2 - 4(10)(-1)}}{2(10)} = \frac{3 \pm \sqrt{9 + 40}}{20}$$

$$= \frac{3 \pm 7}{20} \qquad x = \frac{10}{20}, \frac{-4}{20}$$

$$x = \frac{1}{2}, \frac{-1}{5}$$

-1/5 is ruled out since it's NOT the positive part of the x axis

Problem 10

What is the maximum value of the following function on the interval x < 0?

$$f(x) = 2x^3 + 12x^2 - 30x + 10$$

A. -210

B. -36

C. -5

D. 210

Problem 10

What is the maximum value of the following function on the interval $x < 0$?

$$f(x) = 2x^3 + 12x^2 - 30x + 10$$

$$f'(x) = 6x^2 + 24x - 30$$

$$0 = 6x^2 + 24x - 30$$

$$0 = x^2 + 4x - 5$$

$$0 = (x+5)(x-1) \quad \rightsquigarrow \quad x = 1, -5$$

A. -210
B. -36
C. -5
D. 210

Check:

$$f''(x) = 12x + 24$$

$$f''(-5) = 12(-5) + 24 = -36$$

$$f(-5) = 2\left[(-5)^3\right] + 12\left[(-5)^2\right] - 30(-5) + 10$$

$$f(-5) = 2(-125) + 12(25) + 30(5) + 10$$

$$= -250 + 300 + 150 + 10 = 210$$

$x = -5$

Problem 11

What is the value of the following limit?

$$\lim_{x \to 0} \left[\frac{\sin(5x)}{x} \right]$$

A. 0

B. 0.87

C. 1

5

Problem 11

What is the value of the following limit?

$$\lim_{x \to 0}\left[\frac{\sin(5x)}{x}\right] = \lim_{x \to 0}\left[\frac{\frac{d}{dx}\sin(5x)}{\frac{d}{dx}(x)}\right] = \lim_{x \to 0}\left[\frac{5\cos(5x)}{1}\right]$$

$$= 5\cos(5 \cdot 0)$$
$$= 5\cos(0)$$
$$= 5$$

A. 0

B. 0.87

C. 1

D. 5

Problem 12

What is the partial derivative with respect to "x" of the following function?

$$f(x) = x^2 y^3 + xy^4 + \sin(x) + \cos^2(x) + \sin^3(y)$$

A. $(2x + y) y^3 + 3\sin^2(y)\cos(y)$

B. $(4x - 3y^2) xy^2 + 3\sin^2(y)\cos(y)$

C. $(3x + 4y^2) xy + 3\sin^2(y)\cos(y)$

D. $(2x + y) y^3 + [1 - 2\sin(x)]\cos(x)$

Problem 12

What is the partial derivative with respect to "x" of the following function?

$$\frac{\partial f}{\partial x} = \left(2xy^3 + y^4\right) + \left(\cos(x) + 2\cos(x)\left[-\sin(x)\right]\right)$$

$$= (2x+y)y^3 + \left[1 - 2\sin(x)\right]\cos(x)$$

$$f(x) = x^2 y^3 + xy^4 + \sin(x) + \cos^2(x) + \sin^3(y)$$

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A. $(2x+y)y^3 + 3\sin^2(y)\cos(y)$

B. $(4x-3y^2)xy^2 + 3\sin^2(y)\cos(y)$

C. $(3x+4y^2)xy + 3\sin^2(y)\cos(y)$

D. $(2x+y)y^3 + \left[1-2\sin(x)\right]\cos(x)$

Problem 13

What is the result of the following indefinite integral?

$$\int \left(15x^4 - 8x^3 + \frac{1}{x} + 7\right) dx$$

A. $3x^5 - 2x^4 + \ln|x| + 7x + C$

B. $60x^3 - 24x^2 - x^{-2} + C$

C. $60x^4 - 24x^3 - x^{-2} + 7x + C$

D. $(15/4)x^5 - (8/3)x^4 - x^{-2} + 7x + C$

Problem 13

What is the result of the following indefinite integral?

$$\int \left(15x^4 - 8x^3 + \frac{1}{x} + 7 \right) dx$$

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A. $3x^5 - 2x^4 + \ln|x| + 7x + C$

B. $60x^3 - 24x^2 - x^{-2} + C$

C. $60x^4 - 24x^3 - x^{-2} + 7x + C$

D. $(15/4)x^5 - (8/3)x^4 - x^{-2} + 7x + C$

Problem 14

What is the result of the following indefinite integral?

$$\int \cos^2(x)\sin(x)\,dx$$

A. $-2/3\left[\sin^3(x)\right]+C$

B. $-1/3\left[\cos^3(x)\right]+C$

C. $1/3\left[\sin^3(x)\right]+C$

D. $1/2\left[\sin^2(x)\cos^2(x)\right]+C$

Problem 14

What is the result of the following indefinite integral?

$$\int \cos^2(x)\sin(x)\,dx$$

A. $-2/3\left[\sin^3(x)\right]+C$

B. $-1/3\left[\cos^3(x)\right]+C$

C. $1/3\left[\sin^3(x)\right]+C$

D. $1/2\left[\sin^2(x)\cos^2(x)\right]+C$

Substitution:

$u = \cos(x)$

$du = -\sin(x)\,dx$

$$\int -u^2\,du = -\frac{1}{3}u^3 + C$$

$$\therefore \quad -\frac{1}{3}\cos^3(x) + C$$

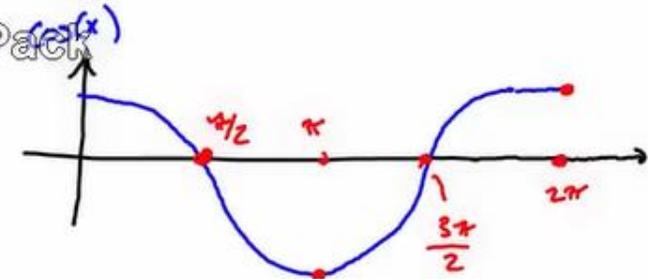To convert without Freemake logo, use Freemake Mega Pack

Problem 15

What is the total area of the region bounded by the x-axis and the curve $y = \sin(x)$ on the interval between $x = \pi/2$ and $x = 2\pi$?

A. 1
B. 2
C. 3
D. 4

Problem 15

What is the total area of the region bounded by the x-axis and the curve $y = \sin(x)$ on the interval between $x = \pi/2$ and $x = 2\pi$?

A. 1

B. 2

C. 3

D. 4

$\sin(x)$

$\cos(x)$
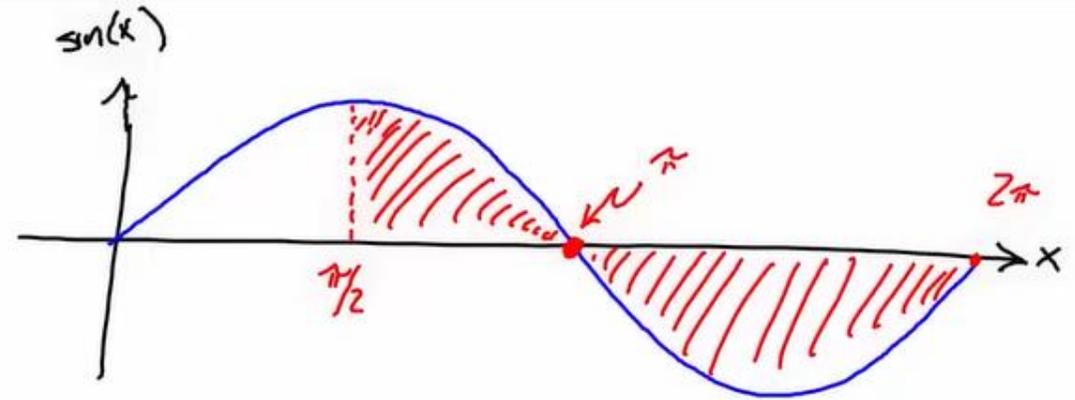
$$\text{Area} = \left| \int_{\pi/2}^{\pi} \sin(x)\, dx \right| + \left| \int_{\pi}^{2\pi} \sin(x)\, dx \right|$$

$$= \left| -\cos(x) \Big|_{\pi/2}^{\pi} \right| + \left| -\cos(x) \Big|_{\pi}^{2\pi} \right|$$

$$= \left| -\left[\cos\pi - \cos\frac{\pi}{2} \right] \right| + \left| -\left[\cos 2\pi - \cos(\pi) \right] \right|$$

$$= \left| -\left[-1 - 0 \right] \right| + \left| -\left[1 - (-1) \right] \right| = |1| + |-2| = 3$$

Problem 16

What is the general solution to the following differential equation?

$$y'' - 8y' + 16y = 0$$

A. $\quad y = C_1 e^{4x}$

B. $\quad y = (C_1 + C_2 x) e^{4x}$

C. $\quad y = C_1 e^{-4x} + C_2 e^{4x}$

D. $\quad y = C_1 e^{2x} + C_2 e^{4x}$

Problem 16

What is the general solution to the following differential equation?

$$y'' - 8y' + 16y = 0$$

$a = -8$
$b = 16$

Characteristic Eqn: $r^2 - 8r + 16 = 0$

$$(r-4)(r-4) = 0$$

$r = 4$ (double root)

$$y = C_1 e^{4x} + x C_2 e^{4x} = e^{4x}(C_1 + C_2 x)$$

A. $y = C_1 e^{4x}$

B. $y = (C_1 + C_2 x) e^{4x}$

C. $y = C_1 e^{-4x} + C_2 e^{4x}$

D. $y = C_1 e^{2x} + C_2 e^{4x}$

$a^2 = 64$

$46 = 64$

Page 52 – critically damped

Problem 17

For the three vectors what is the value
of the following product?

$$\mathbf{A} \cdot (\mathbf{B} \times \mathbf{C})$$

- A = 6i + 8j + 10k
- B = i + 2j + 3k
- C = 3i + 4j + 5k

A. 0
B. 64
C. 80
D. 216

Problem 17

For the three vectors what is the value of the following product?

$$A \cdot (B \times C)$$

- A = 6i + 8j + 10k
- B = i + 2j + 3k
- C = 3i + 4j + 5k

A. 0
B. 64
C. 80
D. 216

Rule of Sarrus

Page 59 – cross product

$$\hat{B} \times \hat{C} = \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ 1 & 2 & 3 \\ 3 & 4 & 5 \end{vmatrix} \begin{matrix} \hat{i} & \hat{j} \\ 1 & 2 \\ 3 & 4 \end{matrix}$$

$$= 10\hat{i} + 9\hat{j} + 4\hat{k} - (12\hat{i} + 5\hat{j} + 6\hat{k})$$

$$= -2\hat{i} + 4\hat{j} - 2\hat{k}$$

Page 59 – dot product

$$\hat{A} \cdot (\hat{B} \times \hat{C}) = (6)(-2) + (8)(4) + (10)(-2)$$

$$= -12 + 32 - 20$$

$$= 0$$

Problem 18

What is the angle between the two
given vectors?

- A = 4i + 12j + 6k
- B = 24i - 8j + 6k

A. -84.32°
B. 84.32°
C. 101.20°
D. 122.36°

Problem 18

What is the angle between the two given vectors?

- A = 4i + 12j + 6k
- B = 24i - 8j + 6k

Pythagorean Theorem in three dimensions

A. -84.32°
B. 84.32°
C. 101.20°
D. 122.36°

$\hat{A} \cdot \hat{B} = 36$

$|\hat{A}| = \sqrt{(4)^2 + (12)^2 + (6)^2} = 14$

$|\hat{B}| = \sqrt{(24)^2 + (-8)^2 + (6)^2} = 26$

$|\hat{A}||\hat{B}| = 364$

$\hat{A} \cdot \hat{B} = |\hat{A}||\hat{B}| \cos(\theta)$ Page 59 – Right-Hand Rule

$\cos\theta = \dfrac{\hat{A} \cdot \hat{B}}{|\hat{A}||\hat{B}|} = \dfrac{36}{364}$

$\therefore \theta = \cos^{-1}\left(\dfrac{36}{364}\right) = 84.32°$

Problem 19

What is the determinant of the
following matrix?

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 7 & 8 & 9 \end{bmatrix}$$

A. -8

B. -4

C. 0

D. 4

Problem 19

What is the determinant of the following matrix?

Page 58

$$\begin{vmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{vmatrix} = a_1b_2c_3 + a_2b_3c_1 + a_3b_1c_2 - a_3b_2c_1 - a_2b_1c_3 - a_1b_3c_2$$

$$A = \begin{bmatrix} 2 & 3 & 4 \\ 5 & 6 & 7 \\ 7 & 8 & 9 \end{bmatrix} \begin{matrix} 2 & 3 \\ 5 & 6 \\ 7 & 8 \end{matrix}$$

Page 58 - 3rd order determinant
Rule of Sarrus

A. -8

B. -4

C. 0

D. 4

Problem 20

The second and sixth terms of a geometric progression are 3/10 and 243/160, respectively. What is the first term of this sequence?

A. 1/10

B. 1/5

C. 3/5

D. 3/2

Problem 20

The second and sixth terms of a geometric progression are 3/10 and 243/160, respectively. What is the first term of this sequence?

Page 50 – Geometric Progression Eqn #5

A. 1/10
B. 1/5
C. 3/5
D. 3/2

$l_1 = a$	l_2	l_3	l_4	l_5	l_6
$\frac{1}{5}$	$\frac{3}{10}$	$\frac{9}{20}$	$\frac{27}{40}$	$\frac{81}{80}$	$\frac{243}{160}$

$$l = ar^{n-1} \quad : \quad l_2 = ar^{2-1} = ar$$

$$l_6 = ar^{6-1} = ar^5$$

$$\frac{l_6}{l_2} = \frac{ar^5}{ar} = r^4$$

$$\frac{l_6}{l_2} = \left(\frac{243}{160}\right) \div \left(\frac{3}{10}\right) = \left(\frac{243}{160}\right)\left(\frac{10}{3}\right) = \frac{81}{16}$$

$$\therefore r^4 = \frac{81}{16} \qquad \therefore r = \left(\frac{81}{16}\right)^{1/4} = \frac{3}{2}$$