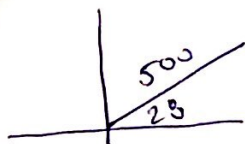


Event 1: Chapter 6

1.) A DC-10 jet aircraft is flying on a bearing of 62° at 500 mph. Find the component form of the velocity of the airplane.



$$\langle 500 \cos 28, 500 \sin 28 \rangle$$

$$\langle 441.47, 234.74 \rangle$$

2

2.) Find the angle, θ , in degrees to the nearest tenth, between the vectors: $\mathbf{u} = 3\mathbf{i} + 5\mathbf{j}$ $\mathbf{w} = 4\mathbf{i} - 2\mathbf{j}$

$$\cos \theta = \frac{12 + -10}{\sqrt{20} \cdot \sqrt{34}} = \frac{2}{\sqrt{34}\sqrt{20}}$$

$$\theta = \cos^{-1} \left(\frac{2}{\sqrt{34}\sqrt{20}} \right) = 85.6$$

2

3.) Kristin is trying to shoot an arrow into a ring on the ground with a diameter of 5 feet. The closest edge of the ring is 72 feet away. The arrow is released 4.5 feet above ground at an angle of 32° and with an initial velocity of 50 ft./sec. (8 points)

A.) Write the parametric equations that represent the location of the arrow.

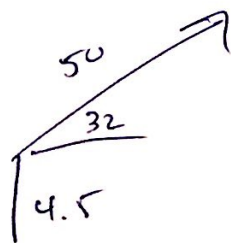
$$x = 50 \cos 32T$$

$$y = -16T^2 + 50 \sin 32T + 4.5$$

2

B.) Will the arrow hit the target. Show algebraic support for your answer, looking at the graph or table in your calculator is not enough.

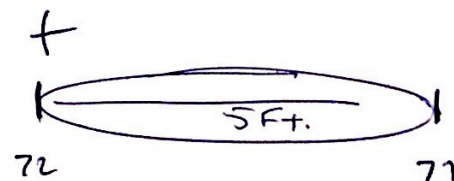
HITS TARGET



$$72 = 50 \cos 32T$$

$$T = 1.698 \text{ sec}$$

$$y = 3.3584 \text{ ft.}$$



$$77 = 50 \cos 32T$$

$$T = 1.8159$$

$$y = -1.14696$$

Hits sec. 4
1.8112757
76.874

Event 3: Chapter 7

NO CALCULATOR

1.) Multiply: $\begin{bmatrix} 2 & -1 & 3 \\ 3 & 2 & -2 \\ 4 & 2 & 1 \end{bmatrix} \begin{bmatrix} 2 & 1 \\ -3 & -4 \\ -1 & 5 \end{bmatrix}$
 $3 \times 3 \quad 3 \times 2$

$$\begin{bmatrix} (4+3-3) & (2+4+15) \\ (6-6+2) & (3-8-10) \\ (8-6-1) & (4-8+5) \end{bmatrix}$$

2

$$\begin{bmatrix} 4 & 21 \\ 2 & -15 \\ 1 & 1 \end{bmatrix}$$

2.) Find the partial fraction decomposition of $\frac{-3x-23}{x^2-x-12} = \frac{-3x-23}{(x-4)(x+3)}$

$$\frac{A}{x-4} + \frac{B}{x+3}$$

$$Ax + 3A + Bx - 4B$$

$$\begin{aligned} A+B &= -3 \\ 3A-4B &= -23 \end{aligned}$$

$$\begin{aligned} 4A+4B &= -12 \\ 3A-4B &= -23 \end{aligned}$$

$$7A = -35$$

$$A = -5$$

$$B = 2$$

$$\frac{-5}{x-4} + \frac{2}{x+3}$$

4

3.) A bakery is making whole-wheat bread and apple bran muffins. For each batch of bread they make \$35 profit. For each batch of muffins they make \$10 profit. The bread takes 4 hours to prepare and 1 hour to bake. The muffins take 0.5 hours to prepare and 0.5 hours to bake. The maximum preparation time available is 16 hours. The maximum baking time available is 10 hours. How many batches of bread and muffins should be made to maximize profits?

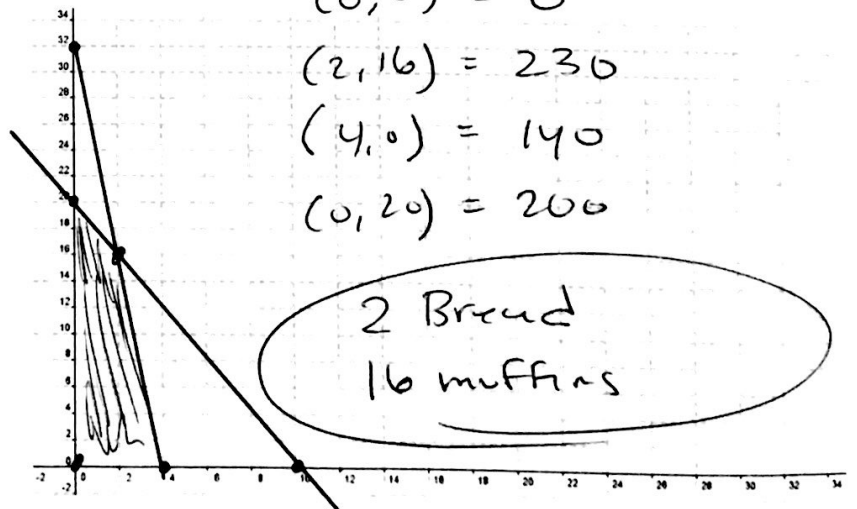
4

~~$B(x) = 4x$~~
 ~~$M(x) = \frac{1}{2}x$~~
 ~~$P(x) = 35x$~~
 ~~$B(y) = y$~~
 ~~$M(y) = \frac{1}{2}y$~~
 ~~$P(y) = 10y$~~

$$4x + \frac{1}{2}y \leq 16$$

$$x + \frac{1}{2}y \leq 10$$

$$35x + 10y = P$$



Event 5: Chapter 8

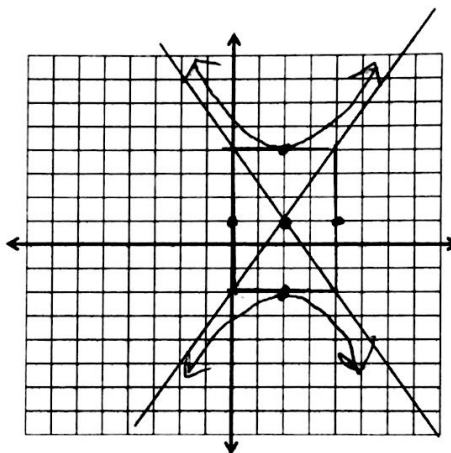
1.) Write the equation in standard form of an ellipse with a vertical major axis length of 12, a horizontal minor axis length of 6 and center, (0, -4).

$$\frac{x^2}{9} + \frac{(y+4)^2}{36} = 1$$

(2)

2.) Graph the hyperbola: $\frac{(y-1)^2}{9} - \frac{(x-2)^2}{4} = 1$.

(1, 2) (2, 1)



(2)

3.) Determine the eccentricity, type of conic and directrix of $r = \frac{20}{10 - 5\cos\theta}$

$$r = \frac{2}{1 - \frac{1}{2}\cos\theta}$$

$$x = -4$$

$$ke = 20$$

$$ke = 2$$

$$k = 4$$

$$e = \frac{1}{2}$$

ellipse

(3)

4.) Complete the square of $-10x^2 + 5y^2 - 20y - 30 = 0$ to write the equation of the conic in standard form. Then identify the type of conic.

$$-10(x^2 + 2y + 1) + 5(y^2 - 4y + 4) = 30 - 10 + 20$$

$$-10x^2 + 5(y^2 - 4y + 4) = 30 + 20$$

$$\frac{-10x^2}{50} + \frac{5(y-2)^2}{50} = \frac{50}{50}$$

$$\frac{(y-2)^2}{10} - \frac{x^2}{5} = 1$$

Hyperbola

(3)

Event 7: Chapter 9

1.) Evaluate $\binom{10}{7}$. $= 120$

(2)

(1)

2.) Find the 7th term in the binomial expansion of $(2x + y)^{11}$.

$$\binom{11}{6} (2x)^5 (y)^6$$

$$462 \cdot 32 x^5 y^6 = \underline{14784 x^5 y^6}$$

(2)

3.) Given: 35, 32, 29, 26, ...

- Identify whether the sequence is arithmetic, geometric, or neither.
- If arithmetic or geometric, identify the common difference or common ratio.
- If arithmetic or geometric, write a recursive rule.
- Write an explicit rule.
- Find a_{11} .

(a) arithmetic

(b) $cd = -3$

(c) $a_n = a_{n-1} - 3$

(d) $a_n = 35 - 3(n-1)$
 $= 35 - 3n + 3$

$a_n = 38 - 3n$

(5)

(e) 5

4.) Find the sum of the series: $\frac{1}{3} + \frac{1}{9} + \frac{1}{27} + \dots + \frac{1}{6561}$.

$$S = \frac{\frac{1}{3} (1 - \frac{1}{3}^8)}{1 - \frac{1}{3}}$$

$$\frac{1}{3} \left(\frac{1}{3}\right)^{n-1} = \frac{1}{6561}$$

$n = 8$

$S = .4999$

(2)

Event 9: Chapter 10

1.) Use the definition to find the derivative of $\sqrt{x-6}$.

$$\lim_{h \rightarrow 0} \frac{\sqrt{(x+h)-6} - \sqrt{x-6}}{h} \cdot \frac{\sqrt{(x+h)-6} + \sqrt{x-6}}{\sqrt{(x+h)-6} + \sqrt{x-6}}$$

$$\lim_{h \rightarrow 0} \frac{x+h-6 - (x-6)}{h(\sqrt{x+h-6} + \sqrt{x-6})} = \frac{1}{2\sqrt{x-6}}$$

3

2.) Use the diagram to find the limits.

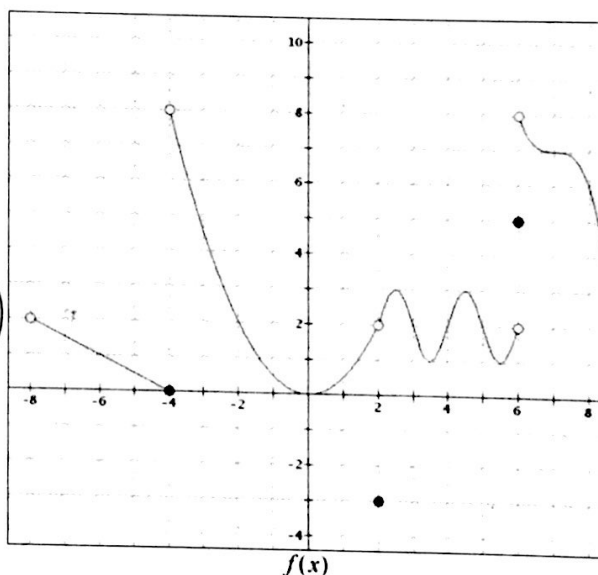
a.) $\lim_{x \rightarrow 6^+} f(x)$ 8

b.) $\lim_{x \rightarrow 6^-} f(x)$ 2

c.) $\lim_{x \rightarrow 6} f(x)$ DNE

d.) $f(6)$ 5

4



3.) Find the equation of the tangent line to the curve when x has the given value.

3

$f(x) = x^2 - 3; x = 2$

$$\lim_{h \rightarrow 0} \frac{(x+h)^2 - 3 - x^2 + 3}{h} = \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 - x^2 - x^2 + 3}{h} = \lim_{h \rightarrow 0} 2x + h$$

$f'(x) = 2x$

(2, 1)

$m = 4$

$y - 1 = 4(x - 2)$
 $y = 4x - 7$