

AOS Math 10, Spring 2024  
Cumulative, Quarter 3  
(Parametric, Polar, Vectors, Complex)

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**Student Signature**

**Class**

**Date**

**Print Name:**

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1. Eliminate the parameter  $t$ :  $x = t^3 - 2$  and  $2y = 1 - t^2$

(a)  $y = 1 + \sqrt[3]{(x+2)^2}$

(b)  $y = 1 - \sqrt[3]{(x+2)^2}$

(c)  $y = 1 + \sqrt{(x+2)^3}$

(d)  $y = 1 - \sqrt[3]{(x+2)^2}$

2. Eliminate the parameter  $t$ :  $x = 4\sin(t) + 1$  and  $y = 3\cos(t) - 2$

(a)  $\frac{(x-1)^2}{3} + \frac{(y+1)^2}{4} = 1$

(b)  $\frac{x^2}{16} + \frac{y^2}{9} = 1$

(c)  $\frac{(x-1)^2}{16} + \frac{(y+1)^2}{9} = 1$

(d)  $\frac{(x-1)^2}{4} + \frac{(y+1)^2}{3} = 1$

3. Convert the polar coordinate  $(6, -2\pi/3)$  to rectangular coordinates

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

(b)  $(-3, -3)$

(c)  $(3, 3\sqrt{3})$

(d)  $(-3, -3\sqrt{3})$

(e)  $(3\sqrt{3}, -3\sqrt{3})$

4. Convert this equation to polar coordinates:  $x^2 - y^2 = 16$

(a)  $r^2 = \frac{16}{\cos^2 \theta + \sin^2 \theta}$

(b)  $r^2 = \frac{4}{\cos^2 \theta + \sin^2 \theta}$

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

(d)  $r^2 = \frac{16}{\cos^2 \theta - \sin^2 \theta}$

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5. Convert this equation to rectangular coordinates:  $r = 3 \sec \theta$

(a)  $x = 1$

(b)  $x = 3$

(c)  $y = 1$

(d)  $y = 3$

6. Which of the following is the graph of  $r = \cos(3\theta)$ .

(a) A 6 leaf rose with  $x$ -intercepts  $(0, 0), (\pm 1, 0)$

(b) A 6 leaf rose with no  $x$  intercept

(c) A 3 leaf rose with no  $x$  intercept

(d) A 3 leaf rose with  $x$ -intercepts  $(0, 0), (1, 0)$

7. A baseball pitcher throws a baseball with an initial speed of 138 feet per second at an angle of  $20^\circ$  to the horizontal. The ball leaves the pitcher's hand at a height of 4 feet above the ground. Write the equations of motion,  $v_x$  and  $v_y$  for velocity and  $s_x, s_y$  for position.

(a)  $v_x(t) = 129.7, v_y(t) = 47.2 - 32t, s_x(t) = 129.7t, s_y(t) = 47.2t - 16t^2 + 4$

(b)  $v_x(t) = 129.7, v_y(t) = 47.2 - 32t, s_x(t) = 129.7t, s_y(t) = 47.2t - 16t^2$

(c)  $v_x(t) = 129.7, v_y(t) = 47.2 + 32t, s_x(t) = 129.7t, s_y(t) = 47.2t - 16t^2$

(d)  $v_x(t) = 129.7, v_y(t) = 47.2 - 16t, s_x(t) = 129.7t, s_y(t) = 47.2t - 16t^2 + 4$

8. Let  $u = \langle -3, 5 \rangle$  and  $\vec{v} = \langle 1, 4 \rangle$  and  $\vec{w} = \langle 6, -3 \rangle$  find  $\vec{u} + 2\vec{v} - \vec{w}$

(a)  $\langle -7, 16 \rangle$

(b)  $\langle -6, 14 \rangle$

(c)  $\langle -7, 14 \rangle$

(d)  $\langle -8, 16 \rangle$

9. Given  $\vec{u} = \langle 3\sqrt{3}, -5 \rangle$ , find  $\|\vec{u}\|$

(a)  $3\sqrt{13}$

(b)  $2\sqrt{17}$

(c)  $2\sqrt{13}$

(d)  $3\sqrt{17}$

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10. Given  $\vec{u} = \langle -10, 9 \rangle$ , find a unit vector in the direction of  $\vec{u}$

(a)  $\langle -\frac{10}{\sqrt{19}}, \frac{9}{\sqrt{19}} \rangle$

(b)  $\langle -\frac{10}{\sqrt{181}}, \frac{9}{\sqrt{181}} \rangle$

(c)  $\langle -\frac{10}{\sqrt{181}}, -\frac{9}{\sqrt{181}} \rangle$

(d)  $\langle -\frac{10}{\sqrt{19}}, -\frac{9}{\sqrt{19}} \rangle$

11. Which vector is perpendicular to  $\langle \frac{2}{3}, -\frac{17}{2} \rangle$

(a)  $\langle -9, -17 \rangle$

(b)  $\langle -9, -\frac{17}{18} \rangle$

(c)  $\langle -9, -\frac{6}{17} \rangle$

(d)  $\langle 9, \frac{18}{3} \rangle$

12. Which vector is parallel to  $\langle \frac{2}{3}, -\frac{17}{2} \rangle$

(a)  $\langle -51, 4 \rangle$

(b)  $\langle 4, -51 \rangle$

(c)  $\langle 25, -2 \rangle$

(d)  $\langle 2, -25 \rangle$

13. What is the radian angle between  $\langle 5, 1 \rangle$  and  $\langle 2, -3 \rangle$

(a) 1.580

(b) 1.480

(c) 1.180

(d) 1.080

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14. If vector  $\vec{x}$  has magnitude 9 and makes an angle of 3.4 radians with the positive  $x$  axis, find the components of  $x$  and write as  $a\hat{i} + b\hat{j}$ .

- (a)  $8.70\hat{i} + 2.30\hat{j}$
- (b)  $-9.20\hat{i} + 3.20\hat{j}$
- (c)  $-8.70\hat{i} - 2.30\hat{j}$
- (d)  $-2.30\hat{i} - 8.70\hat{j}$

15. Write the complex number  $-3 + 9i$  in polar form.

- (a)  $9.49e^{1.89i}$
- (b)  $9.29e^{1.81i}$
- (c)  $9.49e^{1.33i}$
- (d)  $9.59e^{1.79i}$

16. Divide  $10 - 9i$  by  $2 - 4i$ , and express your answer in the form  $a + bi$ .

- (a)  $-\frac{4}{5} - \frac{29}{10}i$
- (b)  $\frac{14}{5} + \frac{11}{10}i$
- (c)  $\frac{14}{5} - \frac{11}{10}i$
- (d)  $-\frac{4}{5} + \frac{29}{10}i$

17. Simplify the product  $\sqrt{7}e^{-i\pi/3} \cdot 3e^{i\pi/5}$ .

- (a)  $3\sqrt{7}e^{2\pi i/15}$
- (b)  $3\sqrt{7}e^{-2\pi i/15}$
- (c)  $3\sqrt{7}e^{\pi i/15}$
- (d)  $3\sqrt{7}e^{-\pi i/15}$

18. Solve the equation  $z^2 - 2z + 5 = 0$  for  $z$  and express your answers in rectangular form.

- (a)  $1 \pm 3i$
- (b)  $1 \pm 2i$
- (c)  $1 \pm \sqrt{5}i$
- (d)  $1 \pm 2i^2$

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19. If  $z = 2 + i$  is one root of a quadratic equation  $x^2 + bx + c$  with real coefficients, what is  $bc$ ?

(a)  $-10$

(b)  $-20$

(c)  $4$

(d)  $8$

20. Factor  $z^2 + 9$  into a product of two binomials.

(a)  $(z + 3i)(z + 3i)$

(b)  $(z + 3)(z - 3)$

(c)  $(z + 3i)(z - 3i)$

(d)  $(z + 3\sqrt{i})(z - 3\sqrt{i})$

21. (Bonus): By multiplying two complex numbers, prove the addition identities for  $\sin$  and  $\cos$ .

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**KEY**

1. D
2. C
3. D
4. D
5. B
6. D
7. A
8. A
9. C
10. B
11. C
12. B
13. C
14. C
15. A
16. B
17. B
18. B
19. B
20. C