Readiness Assurance Outcomes

Before beginning this module, each student should be able to...

- Calculate the area of a parallelogram.
- Find the matrix corresponding to a linear transformation of Euclidean spaces **(Standard(s) A1)**.
- Recall and use the definition of a linear transformation **(Standard(s) A2)**.
- Find all roots of quadratic polynomials (including complex ones), and be able to use the rational root theorem to find all rational roots of a higher degree polynomial.
- Interpret the statement "A is an invertible matrix" in many equivalent ways in different contexts.

Readiness Assurance Resources

The following resources will help you prepare for this module.

- Finding the area of a parallelogram: `https://www.khanacademy.org/math/basic-geo/basic-geo-area-and-perime parallelogram-area/a/area-of-parallelogram`
- Factoring quadratics: `https://www.khanacademy.org/math/algebra2/polynomial-functions/factoring-polynom v/factoring-polynomials-1`
- Finding complex roots of quadratics: `https://www.khanacademy.org/math/algebra2/polynomial-functions/quadratic-equations-with-complex-numbers/v/complex-roots-from-the-quadratic-formula`
- Finding all roots of polynomials: `https://www.khanacademy.org/math/algebra2/polynomial-functions/finding-zeros-of-polynomials/v/finding-roots-or-zeros-of-polynomial-1`
- The Rational Root Theorem: `https://artofproblemsolving.com/wiki/index.php?title=Rational_Root_Theorem`

Readiness Assurance Test

Choose the most appropriate response for each question.

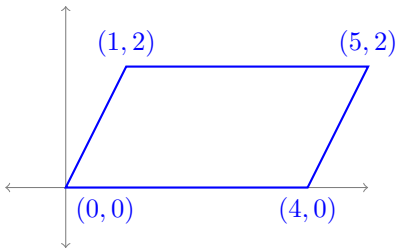
1) Find the area of the parallelogram with vertices $(0,0)$, $(4,0)$, $(5,2)$, and $(1,2)$.

(a) 5

(b) 6

(c) 7

(d) 8



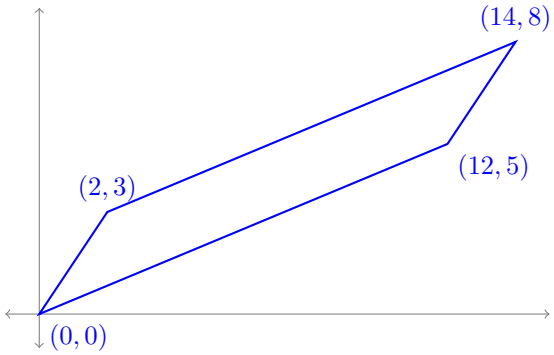
2) Find the area of the parallelogram with vertices $(0,0)$, $(12,5)$, $(14,8)$, and $(2,3)$.

(a) 13

(b) 26

(c) 39

(d) 52



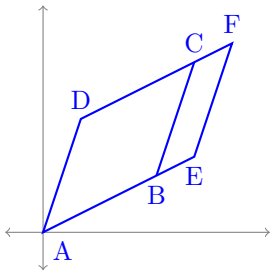
3) The parallelogram ABCD has area 6. If AE is $\frac{3}{2}$ the length of AB, what is the area of the parallelogram AEFD?

(a) 9

(b) 12

(c) 15

(d) 18



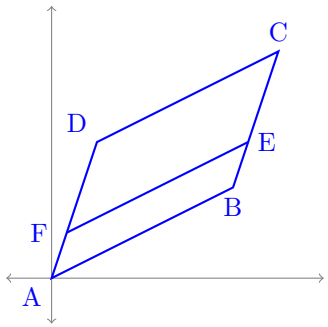
4) The parallelogram ABCD has area 6. If AF is one third as long as AD, what is the area of the parallelogram ABEF?

(a) 1

(b) 2

(c) 3

(d) 4



5) Let $T : \mathbb{R}^2 \to \mathbb{R}$ be a linear transformation. Which of the following is equal to $T\left(\begin{bmatrix} a+b \\ a+b \end{bmatrix}\right)$?

(a) $T\left(\begin{bmatrix} a \\ b \end{bmatrix}\right)$

(b) $2T\left(\begin{bmatrix} a \\ b \end{bmatrix}\right)$

(c) $T\left(\begin{bmatrix} a \\ b \end{bmatrix}\right) + T\left(\begin{bmatrix} b \\ a \end{bmatrix}\right)$

(d) $T\left(\begin{bmatrix} a \\ a \end{bmatrix}\right) + T\left(\begin{bmatrix} a \\ b \end{bmatrix}\right) + T\left(\begin{bmatrix} b \\ a \end{bmatrix}\right) + T\left(\begin{bmatrix} b \\ b \end{bmatrix}\right)$

6) Let $T : \mathbb{R}^n \to \mathbb{R}^n$ be a linear transformation with associated matrix $A \in M_n(\mathbb{R})$. Three of the four answer choices are equivalent to each other; which one is not equivalent to the other three?

(a) A is not an invertible matrix

(b) T has a non-trivial kernel

(c) $\det(A) \neq 0$

(d) $A\vec{x} = \vec{b}$ has multiple solutions for all $\vec{b} \in \mathbb{R}^n$.

7) What is the matrix corresponding to the linear transformation $T : \mathbb{R}^3 \to \mathbb{R}^3$ given by $T\left(\begin{bmatrix} x \\ y \\ z \end{bmatrix}\right) = \begin{bmatrix} 3x + 2y - z \\ y + z \\ x + 7z \end{bmatrix}$?

(a) $\begin{bmatrix} 3 & 2 & -1 \\ 0 & 1 & 1 \\ 1 & 0 & 7 \end{bmatrix}$ (b) $\begin{bmatrix} 3 & 0 & 1 \\ 2 & 1 & 0 \\ -1 & 1 & 7 \end{bmatrix}$ (c) $\begin{bmatrix} 3 & 2 & -1 \\ 1 & 1 & 0 \\ 1 & 7 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 3 & 1 & 1 \\ 2 & 1 & 7 \\ -1 & 0 & 0 \end{bmatrix}$

8) Which of the following conditions imply that the quadratic polynomial $ax^2 + bx + c$ has no real roots?

(a) $a < 0$

(b) $b^2 - 4ac < 0$

(c) $ac - b^2 < 0$

(d) $ab + c^2 < 0$

9) Which of the following is a root of the polynomial $x^2 - 4x + 13$?

(a) $1 + 2i$ (b) $2 - 3i$ (c) $3 + 4i$ (d) $4 - 5i$

10) How many roots does the polynomial $x^4 + 3x^3 + x^2 - 3x - 2$ have?

(a) 1 (b) 2 (c) 3 (d) 4