

Mathematics 5 — Quarter, Year
Midterm 2

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Calculators, notes and books may not be used in this examination.

You may not receive full credit for a correct answer if insufficient work is shown, but you are not required to simplify your answers.

Only writing contained in the provided boxes will be scored.

The exam contains 12 questions with 104 possible points.

(72 points – Recall) Questions R1–R8 are each worth **nine points**.
(16 points – Analysis) Questions A1 and A2 are each worth **eight points**.
(16 points – Synthesis) Questions S1 and S2 are each worth **eight points**.

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R1. A point p on the circle has the property that the arc between $(1, 0)$ and p is $\frac{5}{16}$ ths of a unit circle. In which quadrant does it lie? What fraction of the unit circle lies between $(0, 1)$ and p ?

R2. The graph of the invertible function f is a line with slope 7 that intersects $(2, 9)$. Find an equation for f^{-1} .

R3. Suppose that a line intersects the points $(1, 2)$ and $(5, 3)$. Suppose that a particle has a constant velocity and moves from $(1, 2)$ to $(5, 3)$ in time equal to $\frac{1}{3}$. What is the position of the particle at time t ?

R4. Suppose that L is a line of slope 4 that intersects the origin. Where does L intersect the unit circle?

R5. Sketch the graph of f , where

$$f(x) = (x + 1)(x - 3)^2(x - 4)$$

and then find all x with $f(x) \geq 0$.

R6. Write the improper fraction $\frac{x+1}{x+4}$ as a polynomial plus a proper fraction.

R7. Find the center and radius of a circle given by $x^2 + 4x + y^2 - 6y = -9$.

R8. If a point on the unit circle in the fourth quadrant that has angle measure equal to θ has x coordinates equal to $\frac{1}{3}$, then

(a) $\cos(\theta) =$

and

(b) $\sin(\theta) =$.

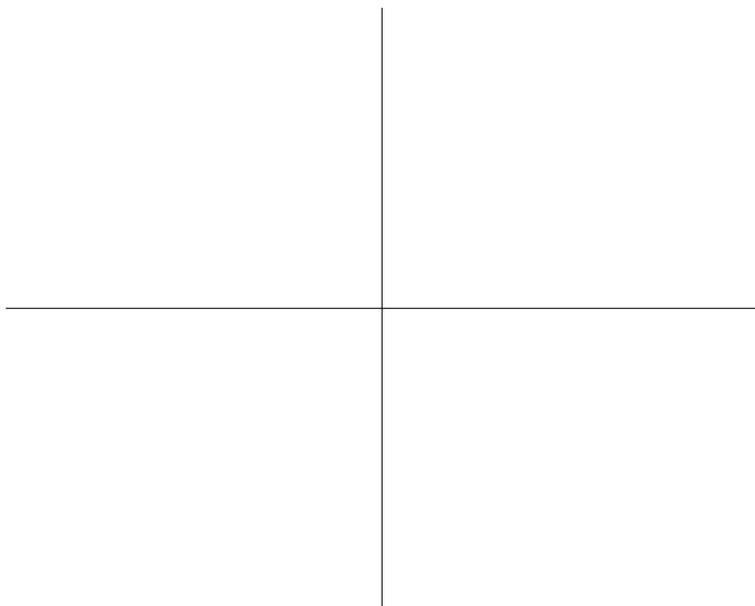
A1. Rotate the point $(2, 5)$ counterclockwise by an angle of 30° about the point $(1, 2)$ to the point p . What are the coordinates of p ? Recall that

$$\cos(30^\circ) = \frac{\sqrt{3}}{2} \quad \text{and} \quad \sin(30^\circ) = \frac{1}{2}.$$

A2. (a) **Sketch the graph** of the rational function f , where f is given by

$$f(x) = \frac{(x+5)^3(x-1)(x-3)^4}{(x+4)(x-2)^2}.$$

(b) Use the graph to **find all x so that $f(x) \leq 0$** .



S1. You enclose a rectangular yard with a fence that borders a large brick wall on one side. You have 400 feet of fencing. What is the maximum area of yard that you can enclose? You will receive **no** credit if you use methods from a calculus class, differentiation for example.

S2. Let f be the piecewise defined function defined by

$$f(x) = \begin{cases} \frac{1}{x+4} & \text{if } x < 1 \text{ and } x \neq -4 \\ (x+1)(x-2) & \text{if } x \geq 1. \end{cases}$$

Write $|f(x)|$ as a piecewise defined function.