Problem 1 Simplify the following expression.

\[(x + y)^3 - (x - y)^3.\]

\[2y(3x^2 + y^2)\]

Problem 2 Find another form of the following expression (here \(x > 1\) and \(0 < h < 1\))

\[\frac{\sqrt{x+h} - \sqrt{x-h}}{h}.\]

\[\frac{2}{\sqrt{x+h} + \sqrt{x-h}}\]

Problem 3 Find the region of the number line on which the inequality is valid.

\[3x^2 - 2x > 1.\]

\[x < -1/3 \text{ or } x > 1\]

Problem 4 A circle in the \(xy\)-plane has center on the \(x\)-axis and contains the points \((-2, 4)\) and \((5, 3)\). Find the \(x\)-coordinate of the center of the circle.

1

Problem 5 How many points of intersection are there between the parabola \(y = x^2\) and the circle with center at \((1, 1)\) and radius \(\sqrt{2}\)?

Two

Problem 6 Reflect the parabola \(y = x^2\) through the line \(x = 1\). Next reflect the resulting parabola through the line \(y = -1\). Find the region on which the final parabola is increasing.

\[x \leq 2\]

Problem 7 Consider the following one-to-one function \(f(x)\) on the given interval.

\[f(x) = \frac{x}{1 + x^2}, \quad 1 \leq x < \infty\]

Find the domain of the inverse function \(f^{-1}(x)\).

\((0, 1/2]\)

Problem 8 A sector of a circle subtends an angle of \(\pi/3\) radians and has an area of \(6\pi\) square cm. Find the arc length of the portion of the circumference in this sector.

\(2\pi\) cm

Problem 9 Compute \(\tan(4\pi/3)\).

\[\sqrt{3}\]

Problem 10 Find an equivalent form of \(\sin(3\theta)\).

\[-4\sin^3(\theta) + 3\sin(\theta)\]