> Instructions: Please self-score your work out of 76 points using the answers and point values below. We recommend that
>
> - Students who score a total above 53 enroll in Math 111L Calculus I;
>
> - Students who scored a total below 53 enroll in Math 105L Calculus I to strengthen their understanding of precalculus material.
>
> Recall this is a self-assessment only: all Calculus I students (both those originally enrolled in Math 105L and those in Math 111L) will take a Calculus I Placement Test on precalculus material on the first day of class. Regardless of results on this self-assessment, students must score above threshold on that test to take Math 111L.
>
> Topics for each question are provided below with the answers if you are interested in reviewing material on your own before the semester begins.
>
> To discuss Calculus I placement, we encourage you to reach out the Math 105L and Math 111L course coordinators, Prof. Rann Bar-On and Prof. Shira Viel, respectively, at `rann.baron@duke.edu` and `shira.viel@duke.edu`.

1. (a) $y = 4x + 21$ (b) $y = -\dfrac{4}{3}x - \dfrac{1}{3}$

   - 4 points: 2 points per part- 1 for slope, 1 for intercept
   - Topic: Lines, including parallel and perpendicular slopes.

2. (a) $2x^2 - x + 4$,   (b) $2x^3 + x^2 - 6x$ (c) $2x^2 + 5x + 2$,   (d) $-\dfrac{1}{3}$,   (e) $2h + 1$,   (f) 1

   - 6 points: 1 point per part
   - Topic: Functions, including function composition and difference quotients

3. (a) $f^{-1}(x) = -\dfrac{2x}{x-1}$,   (b) The function $g(x)$ is not invertible since it is not one-to-one; for example, $g(2) = 4 = g(0)$,   (c) $h^{-1}(x) = \dfrac{1}{3}e^{x+5} - \dfrac{1}{3}$

   - 6 points: 2 points per part (1 point for invertible/not, 1 point for inverse/explanation)
   - Topic: Inverse functions

4. (a) $x^3 y^3$ (b) $2x^{11/10} y^{5/2}$

   - 2 points: 1 point per part
   - Topic: Properties of Exponents

5. (a) Domain: $x > 0$, Range: All real numbers,   (b) $f^{-1}(x) = 10^x$,   (c) $\dfrac{1}{2}$,   (d) 1

   - 4 points: 1 point per part (1/2 pt each for domain and range in (a))
   - Topic: Properties of Logarithms

6. (a) Domain: $x \neq -2$,　(b) $x = -\dfrac{2}{3}, x = \dfrac{2}{3}, x = -\dfrac{1}{2}$,　(c) VA $x = -2$, HA $y = 18$.
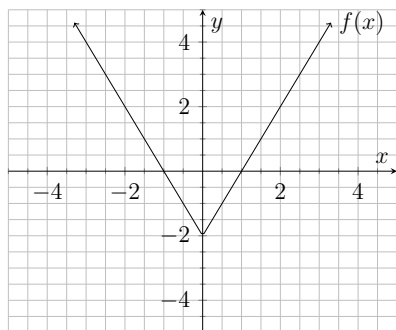
- 6 points: 1 point (a); 3 points (b)- 1 per root; 2 points (c)- 1 per asymptote
- Topics: Factoring, Rational Functions

7. See graphs, intercepts, domains (D), and ranges (R) below.

(a) D: All real numbers, R: All real numbers　　(b) D: All real numbers, R: $-2 \leq x \leq 2$

x-intercept(s): $(-3, 0), (1, 0), (-2, 0)$　　　　x-intercept(s): $\ldots - 4\pi, -2\pi, 0, 2\pi, 4\pi, \ldots$

y-intercept: $(0, -18)$　　　　　　　　　　y-intercept: $(0, 0)$
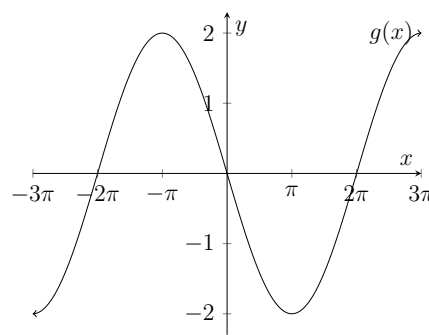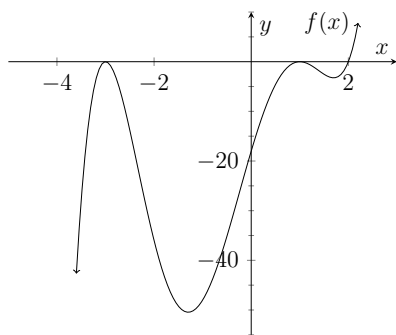
(c) D: All reals, R: $x \geq -2$

x-intercept(s): $(-1, 0), (1, 0)$

y-intercept: $(0, -4)$

- 9 points: 3 points per part (1 for graph, 1 for intercepts, 1 for domain and range)
- Topics: Graphing polynomial and trigonometric functions, graph transformations

8. (a) \$10,　(b) \$17.50,　(c) $C(a) = \begin{cases} 3a & \text{if } 0 \leq a \leq 2 \\ 2.5a & \text{if } 2 < a < 8 \\ 2a + 1.5 & \text{if } a \geq 8 \end{cases}$

- 5 points: 1 point (a), 1 point (b), 3 points (c)- 1 point per piece.
- Topic: Piecewise functions

9. (a) $x = \dfrac{98}{5}$

    (b) $x = \dfrac{\ln 2 - 2\ln 5}{3\ln 2 - \ln 5}$

    (c) $x = 1$

    (d) $x = 0, x = \dfrac{2\pi}{3}$, or $x = \dfrac{4\pi}{3}$

    (e) $x = 0, x = \dfrac{3\pi}{4}, x = \pi$, or $x = \dfrac{7\pi}{4}$

    (f) $x = \dfrac{7}{4}$

    (g) $x \geq 1$ or $x \leq -\dfrac{1}{3}$

    (h) $-1 \leq x \leq 3$

    (i) $x < -3$ or $-2 < x < 0$

    (j) $(x, y) = (4, 27)$ or $(x, y) = (-1, 2)$

    (k) $(x, y, z) = (0, 1, 2)$

    - 22 points: 2 points per part (2/3 pt per answer component in (d), 1/2 pt per component in (e), 1 pt per component in (g),(i),(j). Otherwise no partial credit.)
    - Topics: Solving equations, inequalities, and systems of equations, including those involving polynomials, rational functions, absolute values, logarithms, exponents, and trigonometric functions

10. (a) $\dfrac{180 t^{\circ}}{\pi}$,   (b) a,   (c) a,   (d) $-a$,   (e) t,   (f) $\pi - t$

    - 6 points: 1 point per part
    - Topics: Trigonometric and Inverse Trigonometric Functions

11. (a) 10 ft,   (b) 15 ft,   (c) 15 ft,

    (d) i. $\dfrac{3}{5}$,   ii. $\dfrac{4}{5}$,   iii. $\dfrac{3}{4}$,   iv. $\dfrac{4}{3}$,   v. $\dfrac{5}{4}$,   vi. $\dfrac{5}{3}$

    - 6 points: 1 point per (a),(b),(c), 3 points (d)- 1/2 point per subpart
    - Topics: Similar triangles, Pythagorean Theorem, Trigonometric functions