Midterm Exam A

1. $\sqrt[35]{x^3}$
2. $2x(x-2)(x+5)$
3. $\left(-\frac{18}{5}, -\frac{8}{5}\right]$
4. Sample answer:

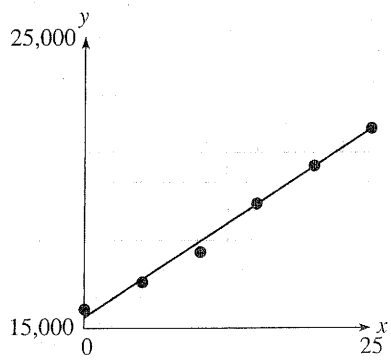
$$\begin{aligned} AB &= \sqrt{[1-(-8)]^2 + (-3-1)^2} \\ &= \sqrt{9^2 + (-4)^2} = \sqrt{81+16} = \sqrt{97}; \\ BC &= \sqrt{[-8-(-4)]^2 + (1-10)^2} \\ &= \sqrt{(-4)^2 + (-9)^2} = \sqrt{16+81} = \sqrt{97}; \\ CD &= \sqrt{(-4-5)^2 + (10-6)^2} \\ &= \sqrt{(-9)^2 + 4^2} = \sqrt{81+16} = \sqrt{97}; \\ AD &= \sqrt{(1-5)^2 + (-3-6)^2} \\ &= \sqrt{(-4)^2 + (-9)^2} = \sqrt{16+81} = \sqrt{97}; \end{aligned}$$

$$m_{\overline{AB}} = \frac{1-(-3)}{-8-1} = -\frac{4}{9} \text{ and}$$

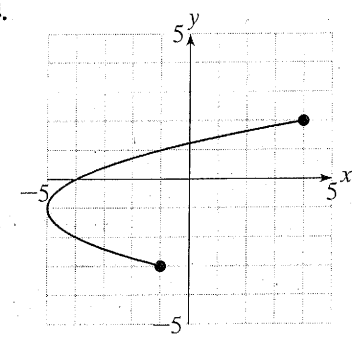
$$m_{\overline{BC}} = \frac{10-1}{-4-(-8)} = \frac{9}{4},$$

so $\overline{AB} \perp \overline{BC}$ since $m_{\overline{AB}} \cdot m_{\overline{BC}} = -1$. Since all four sides have the same length and since one pair of adjacent sides are perpendicular, the points are the vertices of a square. (Note: Other proofs are possible; check students' work.)

5. Approximately $(-\infty, 29.43]$
6. $y = -\frac{2}{5}x + \frac{31}{5}$ or $y = -0.4x + 6.2$
7. $y = 256.51x + 15{,}326.48$;
   2008: About \$23,791



8. $\frac{\ln(x+3)}{\ln 5}$
9. $A(x) = 240x - 2x^2$; $x \approx 30.85$ or $x \approx 89.15$
10. $x \approx -1.30$ or $x \approx 4.37$
11. $x = 2 \pm \sqrt{11}$
12. $(-\infty, 4) \cup (12, \infty)$
13. $g \circ f(x) = x - 2$; Domain: $[3, \infty)$
14.



15. B
16. $f^{-1}(x) = \frac{2x+7}{x-3}$
17. $y = 3x^2 - 12x + 7$
18. B
19. $4(x+2)(x-1)(x-5)$ or $4x^3 - 16x^2 - 28x + 40$
20. Sample answer: According to the lower bound test for real zeros, -2 is a lower bound for the zeroes of $f(x)$ if and only if 2 is an upper bound for the zeros of $f(-x) = x^4 + 3x^3 - 4x^2 - 8x - 2$. Applying the upper bound test for real zeros, we obtain the synthetic division

2	1	3	−4	−8	−2
		2	10	12	8
	1	5	6	4	6

Since the last row contains no negative numbers, 2 is an upper bound for the zeros of $f(-x)$ and -2 is a lower bound for the zeros of $f(x)$.

21. $x = 2 \pm \sqrt{17}\,i$
22. $x^3 + x^2 - 32x + 70$
23. C
24. $g(x) = 3 + \frac{14}{x-4}$: Translate $y = \frac{1}{x}$ four units right, stretch vertically by a factor of 14, and translate three units up. The order may be changed as long as the vertical stretch precedes the upward translation. Asymptotes: $x = 4$, $y = 3$
25. Translate 2 units left, stretch vertically by a factor of 4, and translate 3 units down. The order may be changed as long as the vertical stretch precedes the downward translation.
26. **a.** 16
    b. After 159.78 years
    c. 1216
27. After 6 years