Math 2, Winter 2016

Practice Problems for Midterm 1 — Answers

1. $(0, 1)$ and $(2, \infty)$.
2. Local maximum at $x = 2$, absolute maximum at $x = 2$, no local minima, no absolute minima.
3. 4 feet per second.
4. Increasing on $(-\infty, 0)$ and $(2, \infty)$; decreasing on $(0, 2)$; concave up on $(-1, \infty)$; concave down on $(-\infty, -1)$.
5. 68 feet.
6. Increasing on $(-\infty, -2)$ and $(2, \infty)$; decreasing on $(-2, 2)$; concave up on $(0, \infty)$; concave down on $(-\infty, 0)$.
7. 20π m^2/s.
8. Increasing on $(-\infty, 0)$; decreasing on $(0, \infty)$; concave up on $(-\infty, -1)$ and $(1, \infty)$; concave down on $(-1, 1)$.
9. C.
10. 60 in^3/s.
11. (a) Positive on $\left(-\infty, -\sqrt{2}\right)$ and $\left(\sqrt{2}, \infty\right)$; negative on $\left(-\sqrt{2}, 0\right)$ and $\left(0, \sqrt{2}\right)$; zero at $x = 0, \pm\sqrt{2}$.
    (b) Increasing on $(-1, 0)$ and $(1, \infty)$; decreasing on $(-\infty, -1)$ and $(0, 1)$.
    (c) Concave up on $\left(-\infty, -\frac{1}{\sqrt{3}}\right)$ and $\left(\frac{1}{\sqrt{3}}, \infty\right)$; concave down on $\left(-\frac{1}{\sqrt{3}}, \frac{1}{\sqrt{3}}\right)$.
12. $c = 1$.
13. 54.
14. Negative, increasing, concave up.
15. $x = 0$.
16. $-20\sqrt{3}$ in^2/s.
17. 1 m/s.
18. (a) No horizontal asymptotes; vertical asymptote $x = 0$.
    (b) Increasing on $(-\infty, -3)$ and $(3, \infty)$; decreasing on $(-3, 0)$ and $(0, 3)$.

(c) Concave up on $(0, \infty)$; concave down on $(-\infty, 0)$.

(d) Local minimum at $x = 3$; local maximum at $x = -3$.

19. Horizontal asymptote $x = 1$; vertical asymptote $x = 0$. (Note that $x = 2$ is *not* an asymptote: if you cancel a factor of $x - 2$ from the top and bottom of the fraction, you find that $x = 2$ is a removable discontinuity, with $\lim_{x \to 2} f(x) = 4$.)

20. Increasing on $(-\infty, -3)$ and $(-1, \infty)$; decreasing on $(-3, -1)$; concave up on $(-2, \infty)$; concave down on $(-\infty, -2)$.

21. $\sqrt{5}$, at $x = 2$.

22. $\frac{3}{20\pi}$ cm/hr.