

Rational Functions Review

Answer key Final answers only. Try first, then check.

CORE SKILLS

- K1**
- a) $x = -1, x = 3$ and $y = 0$
 - b) $(1 - \sqrt{5}, 1), (1 + \sqrt{5}, 1), (1 - \sqrt{3}, -1), (1 + \sqrt{3}, -1)$
 - c) $\left(1, -\frac{1}{4}\right)$
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- K2**
- a) VA $x = -\frac{4}{3}$; HA $y = 2$; no hole
 - b) Hole at $\left(-3, \frac{6}{5}\right)$; VA $x = 2$; HA $y = 1$
 - c) VA $x = 1$; oblique asymptote $y = 2x + 5$; no hole
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- K3**
- a) $D = (-\infty, -3) \cup (-3, \infty), R = (-\infty, 2) \cup (2, \infty)$
 - b) $D = (-\infty, 2) \cup (2, \infty), R = (-\infty, 3) \cup (3, \infty)$
 - c) Positive on $(-2, 1) \cup (4, \infty)$; negative on $(-\infty, -2) \cup (1, 4)$
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- K4**
- a) $x = \frac{13}{2}$
 - b) $x = -2$ ($x = 3$ is extraneous)
 - c) $x = -1$ or $x = 4$
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- K5**
- a) $(-\infty, -2) \cup [5, \infty)$
 - b) $(-\infty, 1) \cup \left(\frac{7}{2}, \infty\right)$
 - c) $[-2, -1) \cup (1, 3]$

REAL WORLD

- A1**
- a) $\frac{1}{t} + \frac{1}{t+3} = \frac{1}{2}$
 - b) $t = 3$: the newer pump takes 3 h, the older pump 6 h
 - c) Yes: a pump cannot take -2 hours. The root is valid algebra, but outside the domain $t > 0$ of the situation.
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- A2**
- a) $y = 15$: for very large orders, the average cost gets close to \$15 per hoodie
 - b) $n \geq 120$: at least 120 hoodies
 - c) $\frac{600}{n} = 0$ has no solution: the average cost stays above \$15 for every order size.
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- A3**
- a) $C(1) = 10$ mg/L, $C(10) \approx 4.81$ mg/L; $y = 0$: the concentration falls toward 0 as the body clears the drug
 - b) $1 \leq t \leq 4$, so for 3 hours
 - c) $3t^2 - 10t + 12 = 0$ has no real root (discriminant -44): this dose never reaches 15 mg/L (its peak is 12.5 mg/L, at $t = 2$).

THINK IT THROUGH

- T1**
- a) $f(x) = (x - 1)^2 + 4 \geq 4$, so f has no zeros and $y = \frac{1}{f(x)}$ has no vertical asymptote (only $y = 0$).
 - b) Where f is positive and increasing, $\frac{1}{f}$ decreases: $\frac{1}{f}$ decreases on $(1, \infty)$ and increases on $(-\infty, 1)$.
 - c) $R = \left(0, \frac{1}{4}\right]$; maximum at $\left(1, \frac{1}{4}\right)$

T2

a) $y = \frac{-2x + 10}{x - 3}$ (or $y = -2 + \frac{4}{x - 3}$)

b) e.g. $y = \frac{12(x - 1)}{(x - 1)(x + 2)}$

c) e.g. $y = \frac{x^2 + x}{x^2 + 1}$, which crosses $y = 1$ at $(1, 1)$

BOSS LEVEL

Boss a) Multiply by $(x - 2)(x + 1)$: $x(x + 1) + k(x - 2) = 3$. At $x = 2$ the quadratic equals $3 \neq 0$.

b) $k = -5 \pm 2\sqrt{3}$

c) $k = -1$ or $k = -5 \pm 2\sqrt{3}$

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