

Quiz $[-1, \infty)$ 

() $(2, 5)$ 

$$81^{-\frac{1}{2}} = \frac{1}{9}$$

$$8^{\frac{2}{3}} = 2^2 = 4$$

$$\frac{(pq^2)^3}{(2p^{-2}q)} \cdot \frac{8p}{q^{-3}} = \frac{p^3 q^6 \cdot 8p}{2p^{-2} q \cdot q^{-3}}$$

(Note: The diagram shows the simplification process with annotations: p^3, q^6, 8p, p^2, q^2, and cancellation of terms like p^{-2} and q^{-3}.)

$$= 4p^6 q^8$$

$$a^2 - b^2 = (a - b)(a + b)$$

$$\frac{x^2 - 4}{x + 1} \cdot \frac{x - 1}{x^2 - 3x + 2}$$

$$= \frac{(x + 2)(x - 2)}{x + 1} \cdot \frac{x - 1}{(x - 1)(x - 2)} = \frac{x + 2}{x + 1}, \quad x \neq \pm 1, 2$$

(Note: The diagram shows the cancellation of (x-2) and (x-1) terms with red lines and circles.)

P.

#37 $f(x) = x^4 - 2x^3 - 11x^2$
 $= x^2(x^2 - 2x - 11)$

max at $(0, 0)$

min at $(-1.71, -13.61)$

and $(3.21, -73.32)$



decreasing on $(-\infty, -1.71) \cup (0, 3.21)$

increasing on $(-1.71, 0) \cup (3.21, \infty)$

J. 177 #16 $f(x) = 4 - x^2$ $[1, 1+h]$

ave. rate of change = $\frac{f(1+h) - f(1)}{(1+h) - 1}$

= $\frac{4 - (1+h)^2}{h} = \frac{(4 - 1^2) - \cancel{4} + \cancel{4} - 2h - h^2 - \cancel{3}}{h}$

$$= \frac{\cancel{h}(-2-h)}{h} = -2-h$$

The Difference Quotient

The difference quotient for $f(x)$ at $x=a$ is its average rate of change on $[a, a+h]$.

Ex. Find the DQ for $f(x) = x^2$ at $x=2$.

Use the interval $[2, 2+h]$.

$$\begin{aligned} \frac{f(2+h) - f(2)}{2+h - 2} &= \frac{(2+h)^2 - 2^2}{h} \\ &= \frac{\cancel{4} + 4h + h^2 - \cancel{4}}{h} = \frac{\cancel{h}(4+h)}{h} = 4+h \end{aligned}$$

Find the difference quotient for
 $f(x) = 4 - 2x - 3x^2$ at $x = 3$.

$[3, 3+h]$

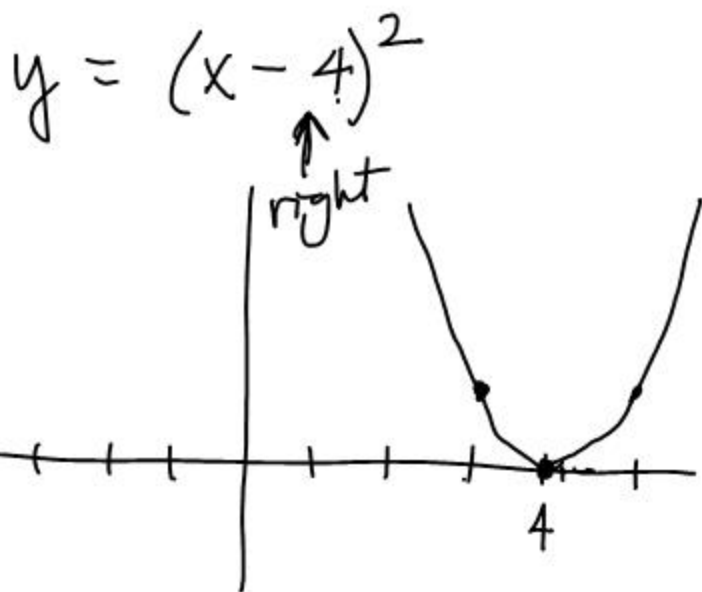
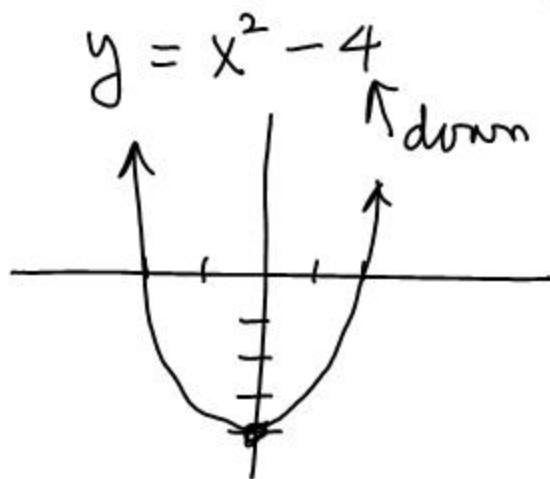
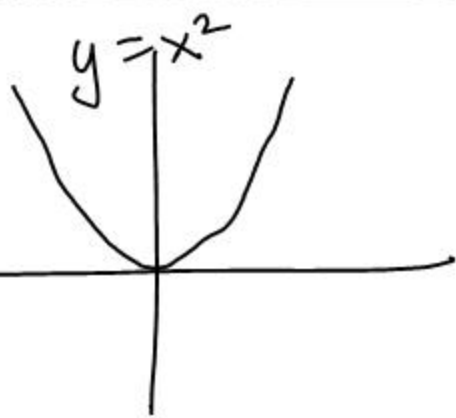
$$\frac{f(3+h) - f(3)}{h}$$

$$= \frac{[4 - 2(3+h) - 3(3+h)^2] - [4 - 2(3) - 3(3)^2]}{h}$$

$$= \frac{\cancel{4} - 6 - 2h - \cancel{21} - 18h - 3h^2 - \cancel{4} + 6 + \cancel{21}}{h}$$

$$= \frac{\cancel{h}(-20 - 3h)}{\cancel{h}} = -20 - 3h$$

Transformations of Graphs



#55

$$g(x) = (x - 2)^2$$

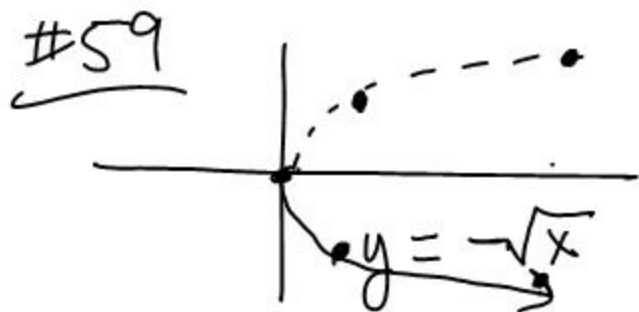
#56

$$g(x) = x^3 + 3$$

#57

$$g(x) = |x + 1| + 2$$

↑ left ↑ up



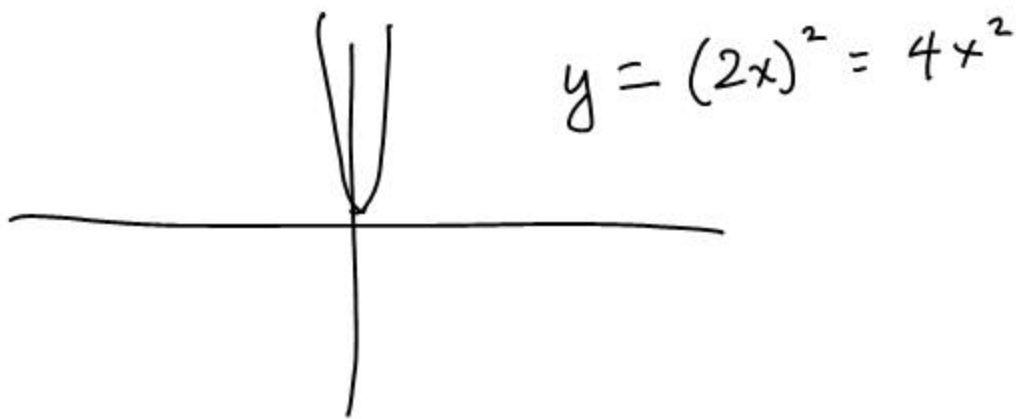
- $f(x)$ flips $f(x)$ over the x -axis

$$g(x) = -\sqrt{x + 2}$$

$$\#60 \quad g(x) = -\underbrace{(x-2)}^2 + \underbrace{1}$$

$$- (1-2)^2 + 1 = 0$$

- #61. (1) $f(x) + 3$ (2) $2f(x+6) + 3$
 (3) $f(x-4)$ (4) $-f(2x)$



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|----|--|
| HW | Find the DQ for the function at the given point. |
|----|--|
- (1) $f(x) = x^3$ at $x = 2$
- (2) $f(x) = 3x^2 - 2x + 5$ at $x = 1$
- (3) $f(x) = 4 - 9x^2$ at $x = -2$
- p. 187 # 21-32,
37, 38