

# Classroom Voting Questions: Calculus I

## 4.3 Families of Curves

1. The functions in Figure 4.4 have the form  $y = A \sin x$ . Which of the functions has the largest  $A$ ? Assume the scale on the vertical axes is the same for each graph.

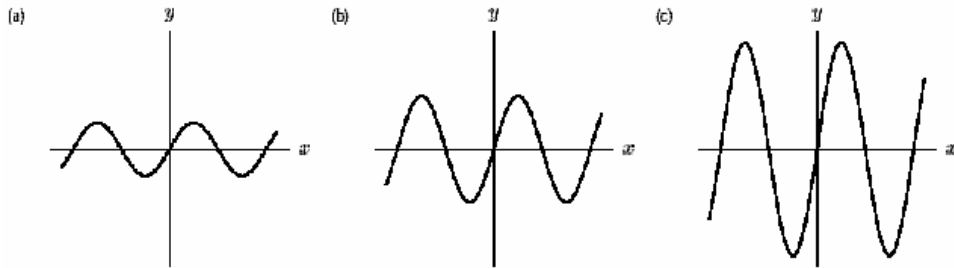


Figure 4.4

*Answer: (c).*

SVC.04.02.010

CC HZ MA131 F05: 0/0/**100**

CC HZ MA122 S06: 20/0/**80**

CC KC MA131 F05: 0/0/**100**

CC HZ MA131 F06: 0/0/**100**

CC KC MA121 F06: 4/0/**96**

CC HZ MA131 F07: 0/0/**100** time 0:40

CC JS MA131 F07: 0/0/**100** time 1:00

CC KC MA121 F07: 4/0/**96** time 1:40

CC LV MA121A S09: 40/5/**54** time 1:50

CC LV MA121B S09: 50/5/**45** time 1:30

CC HZ MA131 F09: 0/0/**92**/4 time 1:05

CC HZ MA131 F10: 0/0/**100** time 1:10

AS DH MA2513 010 S12: 56/22/**6**/17 time 1:40

CC HZ MA131 F11: 0/0/**91**

CC KC MA131 F14: 0/0/**100** time :40

CC KC MA131 S15: 0/0/**100**

2. The functions in Figure 4.5 have the form  $y = \sin(Bx)$ . Which of the functions has the largest  $B$ ? Assume the scale on the horizontal axes is the same for each graph.

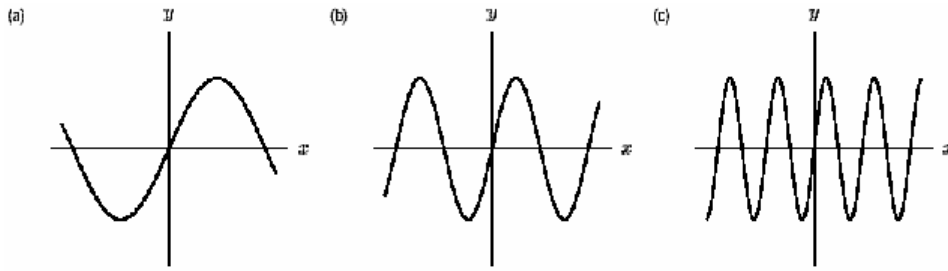


Figure 4.5

Answer: (c).

SVC.04.02.020

CC HZ MA131 F05: 70/0/30

CC HZ MA 122 S06: 90/0/10

CC KC MA131 F05: 36/0/65

CC HZ MA131 F06: 40/0/60

CC KC MA121 F06: 33/0/67

CC HZ MA131 F07: 53/0/47 time 0:40

CC JS MA131 F07: 31/0/69 time 0:35

CC KC MA121 F07: 17/0/83 time 2:50

CC HZ MA131 F09: 72/0/28 time 0:30

CC HZ MA131 F10: 48/0/52 time 1:15

CC TM MA122 S12: 42//58

CC KC MA121A F11: 45/10/45 "Individual, pre-discussion vote"

CC KC MA121A F11: 9/0/91 Post small-group discussion vote

CC KC MA121D F11: 14/0/86

CC HZ MA131 F11: 32/0/68 time 1:30

CC HZ MA131 F12: 43/0/57 time 1:00

CC KC MA131 F14: 50/0/50 time :30

CC KC MA131 S15: 33/0/67 time 1:00

3. Let  $f(x) = ax + b/x$ . What are the critical points of  $f(x)$ ?

(a)  $-b/a$

(b) 0

(c)  $\pm\sqrt{b/a}$

(d)  $\pm\sqrt{-b/a}$

(e) No critical points

Answer: (c,e). (c) if  $a$  and  $b$  are either both positive or both negative; (e) if  $a$  and  $b$  have opposite signs

SVC.04.02.030

CC HZ MA131 F05: 10/**40**/40/**10**  
 CC HZ MA 122 S06: 0/0/**60**/0/**40**  
 CC KC MA131 F05: 0/17/**39**/36/**17**  
 CC HZ MA131 F06: 5/15/**60**/10/**10**  
 CC KC MA121 F06: 0/0/**59**/0/**41**  
 CC HZ MA131 F07: 7/0/**67**/20/**7** time 3:10  
 CC JS MA131 F07: 0/12/**69**/6/**12** time 2:50  
 CC KC MA121 F07: 0/0/**92**/4/4 time 5:00  
 CC HZ MA131 F09: 8/4/**68**/20/0 time 3:20  
 CC HZ MA131 F10: 0/0/**75**/15/10 time 3:00  
 CC TM MA122 S12: 37/5/**53**/5  
 CC KC MA121A F11: 0/24/**52**/5/19 "Individual, pre-discussion vote"  
 CC KC MA121A F11: 5/5/**80**/10/0 Post small-group discussion vote  
 CC KC MA121D F11: 7/7/**71**/14 time 3:45  
 CC HZ MA131 F11: 0/0/**85**/15/0 time 4:00  
 CC HZ MA131 F12: 5/0/**50**/35/10 time 3:30  
 CC KC MA131 F14: 5/14/**81**/0/0 time 3:45

4. Let  $f(x) = ax + b/x$ . Suppose  $a$  and  $b$  are positive. What happens to  $f(x)$  as  $b$  increases?

- (a) The critical *points* move further apart.
- (b) The critical *points* move closer together.

*Answer:* (a). Critical points are at  $x = \pm\sqrt{b/a}$ .

SVC.04.02.040

CC HZ MA131 F05: **80**/20  
 CC HZ MA 122 S06: **75**/25  
 CC KC MA131 F05: **87**/13  
 CC HZ MA131 F06: **90**/10  
 CC KC MA121 F06: **100**/0  
 CC HZ MA131 F07: **93**/7 time 1:00  
 CC JS MA131 F07: **81**/19 time 1:30  
 CC KC MA121 F07: **96**/4 time 2:30  
 CC HZ MA131 F09: **88**/12 time 1:00  
 CC HZ MA131 F10: **82**/18 time 1:30  
 CC TM MA122 S12: **100**  
 CC KC MA121A F11: **86**/14 "Individual, pre-discussion vote"  
 CC KC MA121A F11: **100**/0 Post small-group discussion vote  
 CC KC MA121D F11: **100**/0 time 2:45  
 CC HZ MA131 F11: **100**/0 time 1:40  
 CC HZ MA131 F12: **100**/0 time 1:00

CC KC MA131 F14: **95**/5 time 2:00

5. Let  $f(x) = ax + b/x$ . Suppose  $a$  and  $b$  are positive. What happens to  $f(x)$  as  $b$  increases?

- (a) The critical *values* move further apart.
- (b) The critical *values* move closer together.

*Answer: (a).* Critical values are at  $y = \pm 2\sqrt{ab}$ . Note that this question is the same as the above, but the answers are different: Asking about critical values instead of points.

SVC.04.02.050

CC HZ MA131 F06: **70**/30

CC KC MA121 F06: **74**/26

CC HZ MA131 F07: **60**/40 time 2:30

CC JS MA131 F07: **27**/73 time 1:30

CC HZ MA131 F09: **52**/48 time 1:30

CC HZ MA131 F10: **45**/55 time 2:00

CC TM MA122 S12: **50**/50

CC HZ MA131 F11: **81**/19 time 4:00

CC HZ MA131 F12: **78**/22 time 2:45

CC KC MA131 F14: **77**/23 time 3:25

6. Let  $f(x) = ax + b/x$ . Suppose  $a$  and  $b$  are positive. What happens to  $f(x)$  as  $a$  increases?

- (a) The critical *points* move further apart.
- (b) The critical *points* move closer together.

*Answer: (b).* We take the derivative to get  $f'(x) = a - b/x^2$ . We set this equal to zero, and solve for the critical points  $x = \pm\sqrt{b/a}$ . Thus as  $a$  increases, (b) the critical points get closer together.

SVC.04.02.060

CC KC MA131 F05: 4/**96**

CC HZ MA131 F06: 0/**100**

CC KC MA121 F06: 82/**18**

CC HZ MA131 F07: 13/**87** time 1:10

CC JS MA131 F07: 40/**60** time 0:50

CC HZ MA131 F09: 25/**75** time 1:00

CC HZ MA131 F10: 5/**95** time 0:45

7. Let  $f(x) = ax + b/x$ . Suppose  $a$  and  $b$  are positive. What happens to  $f(x)$  as  $a$  increases?

- (a) The critical *values* move further apart.
- (b) The critical *values* move closer together.

*Answer: (a).* We take the derivative to get  $f'(x) = a - b/x^2$ . We set this equal to zero, and solve for the critical points  $x = \pm\sqrt{b/a}$ . To get the critical values, we put these critical points into the function to get  $f(\pm\sqrt{b/a}) = \pm 2\sqrt{ab}$ . Thus as  $a$  increases, (a) The critical values move farther apart.

SVC.04.02.070

CC KC MA131 F05: **91**/9  
CC HZ MA131 F06: **50**/50  
CC HZ MA131 F07: **53**/47 time 0:40  
CC JS MA131 F07: **79**/21 time 0:25  
CC HZ MA131 F09: **92**/8 time 0:30  
CC HZ MA131 F10: **62**/38 time 0:30  
CC KC MA121A F11: **20**/80  
CC KC MA121D F11: **0**/100 time 1:40

8. Find a formula for a parabola with its vertex at (3,2) and with a second derivative of -4.

- (a)  $y = -4x^2 + 48x - 106$ .
- (b)  $y = -4x^2 + 24x - 34$ .
- (c)  $y = -2x^2 + 12x - 16$ .
- (d)  $y = -2x^2 + 4x + 8$ .

*Answer: (c).* Any parabola can be written in the form  $y = ax^2 + bx + c$ . We know that the second derivative is -4, so  $a = -2$ . We know that the vertex is at (3,2), so this means that  $y'(3) = 0$ . Thus  $-4(3) + b = 0$ , and so  $b = 12$ . Finally we know that  $y(3) = 2 = -4 \cdot 3^2 + 12 \cdot 3 + c = 2$ , and so  $c = -16$ .

SVC.04.02.080

CC LV MA121A S09: 0/30/**65**/5 time 3:00  
CC LV MA121B S09: 0/5/**95**/0 time 3:00  
CC HZ MA131 F09: 0/12/**60**/28 time 2:30  
CC HZ MA131 F12: 0/0/**41**/59 time 4:15  
CC KC MA131 F14: 0/0/**100**/0 time 4:30  
CC KC MA131 S15: 0/4/**88**/8