

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.

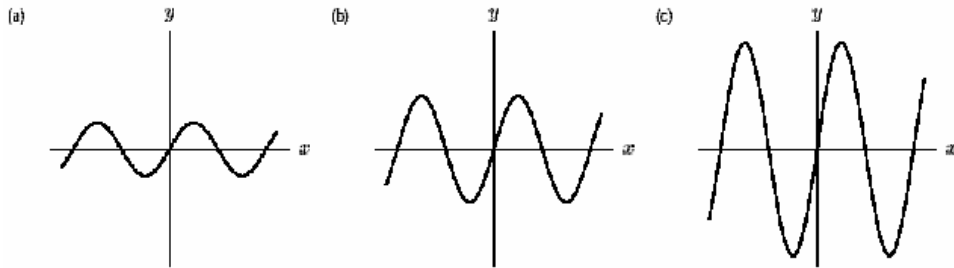


Figure 4.4

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

CC KC MA131 F15: 0/0/100 time 0:30

CC KC MA131 S16: 12/0/88 time 0:30

CC KC MA131 F16: 0/0/100

CC KC MA131 S17: 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.

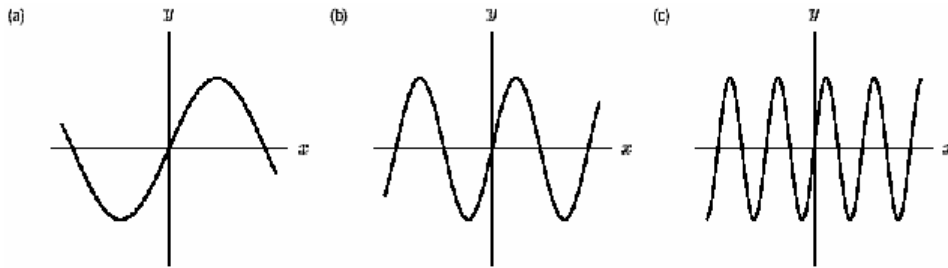


Figure 4.5

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

CC KC MA131 F15: 12/0/88 time 1:00

CC KC MA131 S16: 52/0/48 time 1:00

CC KC MA131 F16: 6/0/94

CC KC MA131 S17: 6/0/94

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
CC KC MA131 F15: 0/0/**100**/0/0 time 4:00
CC KC MA131 S16: 4/9/**61**/22/4 time 3:10
CC KC MA131 F16: 0/24/**70**/0/6
CC KC MA131 S17: 0/0/**89**/11/0

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
 CC KC MA131 F15: **100**/0 time 1:00
 CC KC MA131 S16: **96**/4 time 1:00
 CC KC MA131 F16: **83**/17
 CC KC MA131 S17: **94**/6

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
 CC KC MA131 F15: **38**/62 time 2:00 Rich discussion
 CC KC MA131 S16: **79**/21 time 2:15
 CC KC MA131 F16: **89**/11
 CC KC MA131 S17: **83**/17

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

CC KC MA131 F15: 0/**100** time 1:45

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

CC KC MA131 F15: **100**/0 time 2:00

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

CC KC MA131 F15: 0/6/**88**/6 time 3:30

CC KC MA131 S16: 8/0/**59**/33 time 3:45

CC KC MA131 F16: 6/0/**88**/6

CC KC MA131 S17: 0/0/**83**/17