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9 a) $f(x) = -2x^2 + 12x - 10$

$f(x) + 10 = -2x^2 + 12x$

$f(x) + 10 = -2(x^2 - 6x)$

$f(x) + 10 - 18 = -2(x^2 - 6x + 9)$

$f(x) - 8 = -2(x-3)^2$

$f(x) = -2(x-3)^2 + 8$

b) concave down ✓

vertex (3, 8) ✓

10 a) conc down. max at vertex $x = \frac{-20}{-8}$ $x = 2.5$, sub ... $y = 62$

max $y = 62$ (at $x = 2.5$)

domain: $x \in R$ range: $y \in R \mid y \leq 62$

11. $f(x) = 12x^2 - 78x + 126$ vertex formula $\frac{78}{24}$ $x = 3.25$ (sub) $y = -0.75$

12 a) $y = x^2 + 8x + 30$

$y = (x^2 + 8x + 16) - 16 + 30$

$y = (x+4)^2 + 14$

3 errors → 8x became 4x; → should be 16; → added but not subtracted.

b) $y = 2x^2 - 9x - 55$

$y = 2(x^2 - 4.5x) - 55$

didn't square half of -4.5 (squared 4.5)

$y = 2(x^2 - 4.5x + 5.0625 - 5.0625) - 55$

$y = 2(x - 2.25)^2 - 10.125 - 55$

$y = 2(x - 2.25)^2 - 65.125$

c) $y = 8x^2 + 16x - 13$

$y = 8(x^2 + 2x) - 13$

$y = 8(x^2 + 2x + 1 - 1) - 13$

$y = 8(x+1)^2 - 8 - 13$

$y = 8(x+1)^2 - 21$

$\frac{1}{2}$ of 2 is 1 → squared is 1 (they squared 2)

d) $y = -3x^2 - 6x$

$y = -3(x^2 + 2x)$

$y = -3(x^2 + 2x + 1 - 1)$

didn't factor properly

$y = -3(x+1)^2 + 3$

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13. $C = 75n^2 - 1800n + 60000$ min at vertex $n = \frac{1800}{150}$ $n = 12$

12 items will minimize costs
(12 000)

14. $h = -5t^2 + 10t + 4$ max at vertex $t = \frac{10}{10}$ $t = 1$

$h = -5 + 10 + 4$

$h = 9m$

17. $d = 0.03125x^2 - 1.5x$

$d = 0.03125(x^2 - 48x)$

$d + 18 = 0.03125(x^2 - 48x + 576)$

$d + 18 = 0.03125(x - 24)^2$

$d = 0.03125(x - 24)^2 - 18$

vertex $(24, -18)$

minimum depth is 18 cm

18. I = price × sales

$I = 70\ (2000)$ "old"

let x = \$1 decrease

$I = (70 - x)(2000 + 50x)$ "new"

x int: $(70, 0)$ $(-40, 0)$

vertex (symmetry) at $x = 15$ $I = 151250$

a) revenue \$151250
ticket price \$55

b) $2000 + 50(15) = 2750$ tickets

c) 2750 seats are available

19. R = price × sales

$R = 360 \times 280$ "old"

let x = \$10 price increase

(a) $R = (360 + 10x)(280 - 5x)$

x int: $(-36, 0)$ $(56, 0)$

max at $x = 10$

$y = 105800$

(b) revenue 105800
price $360 + 10(10)$ \$460

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20. "old" yield = rows × yield/row

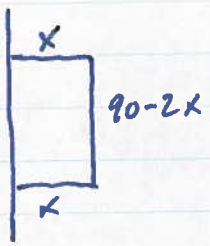
$Y = 30 \times 4000$ let x = extra row

(a) "new" $Y = (30+x)(4000-100x)$

(b)

x int: $(-30, 0)$ $(40, 0)$ 35 rows

max at $x = 5$ 122500 g

21. 

(b) $A = x(90-2x)$

$(0,0)$ $(45,0)$

(c) max if $x = 22.5$

$A = 22.5(90-45)$ $1012.5\ m^2$

22. $A = 2x(3y)$ fencing: $900 = 9y + 6x$

$A = 6xy$ $6x = 900 - 9y$

$A = (900 - 9y)y$

y int: $(100, 0)$ $(0, 0)$

max if $y = 50$ $A = (900-450)(50)$

$A = 22500\ m^2$

$6x = 900 - 450$

$6x = 450$

$x = 75$ big rectangle 75×150

3 small rectangles 75×50

23. a) $x + y = 29$ $P = xy$

$y = 29 - x$ $P = x(29-x)$

x int $(0,0)$ $(29,0)$

max if $x = 14.5$

$y = 14.5$ Product 210.25

b) $x - y = 13$ $P = xy$

$x = 13 + y$ $P = (13+y)y$

y int $(-13, 0)$ $(0,0)$ numbers 6.5, -6.5

min at $y = -6.5$ product -42.25

$x = 6.5$

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24.

$A = 2xy$ string: $450 = 4x + 3y$

$\frac{450 - 4x}{3} = y$

$A = 2x\left(\frac{450 - 4x}{3}\right)$

xint $(0,0)$ $(\frac{450}{4}, 0)$

max if $x = \frac{450}{8}$ $x = 56.25$ $y = 75$

$A = 8437.5\ cm^2$

25. $y = -\frac{3}{4}x^2 + \frac{9}{8}x + \frac{5}{16}$

$y - \frac{5}{16} = -\frac{3}{4}x^2 + \frac{9}{8}x$

$y - \frac{5}{16} = -\frac{3}{4}(x^2 - \frac{3}{2}x)$

$y - \frac{5}{16} - \frac{27}{64} = -\frac{3}{4}(x^2 - \frac{3}{2}x + \frac{9}{16})$

$y - \frac{47}{64} = -\frac{3}{4}(x - \frac{3}{4})^2$

$y = -\frac{3}{4}(x - \frac{3}{4})^2 + \frac{47}{64}$

Hilroy