Review and EQAO Practice for Chapter 9 - Optimization

2015

26 The table below lists the widths of four rectangles, each with an area of 72 cm^2. fixed

optimization

$A = l \cdot w$

$l = \frac{A}{w}$

$P = 2l + 2w$

	Width (cm)	Length (cm)	Perimeter (cm)
Rectangle 1	6	$\frac{72}{6} = 12$	$2(6)+2(12)=36$
Rectangle 2	8	$\frac{72}{8} = 9$	$2(8)+2(9)=34$
Rectangle 3	10	$\frac{72}{10} = 7.2$	$2(10)+2(7.2)=34.4$
Rectangle 4	18	$\frac{72}{18} = 4$	$2(18)+2(4)=44$

Which rectangle has the smallest perimeter?

a Rectangle 1
b Rectangle 2
c Rectangle 3
d Rectangle 4

optimization

27 Salt is sold in packages in the shape of a rectangular-based prism that is not a cube. A new package in the shape of a cube is designed to contain the same volume.

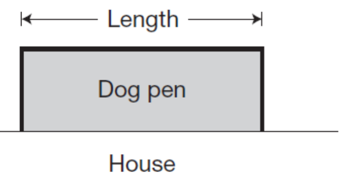
Which of the following is true about the new package?

a It holds less salt.
b It holds more salt.
c It requires less material.
d It requires more material.

A cube shaped prism will give the maximum volume and minimum surface area (less material)

2013

24 Marcus is building a rectangular dog pen along the side of his house as shown below.



Marcus has 20 m of fencing for the 3 sides of the dog pen.

What is the length of the dog pen with the maximum area?

a 4 m
b 5 m
c 10 m
d 12 m

$\boxed{l = 2w}$

$P = w + l + w$

$P = w + 2w + w$

$P = 4w$

$20 = 4w$

$w = \frac{20}{4}$

$w = 5\text{m}$

$l = 2w$

$l = 2(5)$

$l = 10\text{m}$

Why is optimization useful? Identify 3 examples where optimization is used in mathematics.

1. minimize SA when designing packages & containers to save \$
2. minimize SA to reduce heat loss
3. maximize volume when designing packages & containers

determine the best solution while given certain conditions

Challenge Angle Questions

opposite angle theorem

OAT

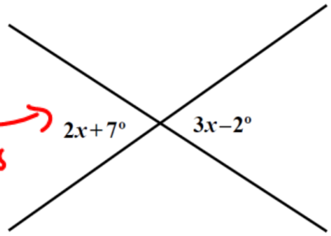
a)

$2x+7=3x-2$

collect like terms

$7+2=3x-2x$

$\boxed{9=x}$



b)

supplementary angle theorem

SAT

$3x-7+2x-8=180°$

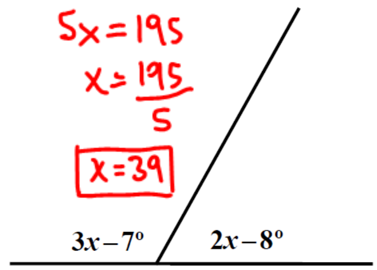
$5x-15=180$

$5x=180+15$

$5x=195$

$x=\frac{195}{5}$

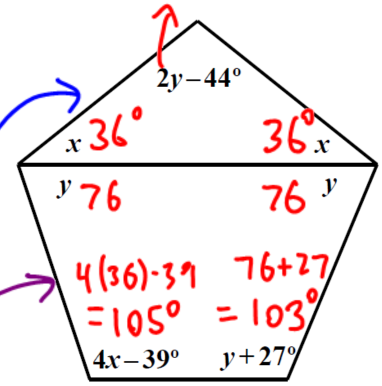
$\boxed{x=39}$



c)

$=2(76)-44$

$=108°$



Answers: **a) 9°** **b) 39°** **c) 41°**

trapezoid

$y+y+4x-39+y+27=360$

$3y+4x=360+39-27$

(2) $\boxed{3y+4x=372}$

triangle

$x+x+2y-44=180$

$2x+2y=180+44$

$2x+2y=224$

divide everything by 2

$\frac{\cancel{2}x}{\cancel{2}}+\frac{\cancel{2}y}{\cancel{2}}=\frac{224}{2}$

(1) $\boxed{x+y=112}$

$x=112-y$

substitute

$3y+4(112-y)=372$

$3y+448-4y=372$

$-y=372-448$

$-y=-76$

$\boxed{y=76}$

substitute back to find x

$x=112-76$

$\boxed{x=36}$

cylinder

Optimization Questions Volume $1ml = 1cm^3$ $355ml = 355cm^3$

1. Pop cans typically hold 355 ml of drink. If you worked for Coke, how would you re-design the pop can so that still holds 355 ml but will require the minimum amount of aluminum (minimum surface area) to produce?

SA

$V = \pi r^2 h$

$\therefore$ sub $h = 2r$

$V = \pi r^2 (2r)$

$V = 2\pi r^3$

$355 = 2\pi r^3$

$\frac{355}{2\pi} = r^3$

$r = \sqrt[3]{\frac{355}{2\pi}}$

$r = 3.83cm$

$h = 2r$

$h = 2(3.83)$

$h = 7.66cm$

$SA = 2\pi r^2 + 2\pi rh$

$SA = 2\pi(3.83)^2 + 2\pi(3.83)(7.66)$

$SA = 276.5cm^2$

2. The BEHR paint company is redesigning it's cans in order to optimize their volume. If each can is constructed from 2834 cm² of aluminum, what is the maximum amount of paint they can hold?

SA volume=?

$SA = 2\pi r^2 + 2\pi rh$

sub $\boxed{h = 2r}$

$SA = 2\pi r^2 + 2\pi r(2r)$

$SA = 2\pi r^2 + 4\pi r^2$

$SA = 6\pi r^2$

$2834 = 6\pi r^2$

$\frac{2834}{6\pi} = r^2$

$\sqrt{\frac{2834}{6\pi}} = r$

$r = 12.26cm$

$h = 2r$

$h = 2(12.26)$

$h = 24.52cm$

$V = \pi r^2 h$

$V = \pi(12.26)^2(24.52)$

$V = 11,578.5cm^3$

Optimization Review – pg. 516 #3, 4, 5, 7, 8, 10, 11, 13, 14, 16

Optimization Practice Test – pg. 518 #1-10