

## Watch. Practice. Understand. | Lesson 292

### Classic Calculus Optimization Problems

Watch the matching video: <https://www.youtube.com/watch?v=yZnaUnDeTQ0>

Practice focus: Optimization

Original extra practice matched to the listed lesson topic.

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Show your reasoning and check units.

**01** A rectangle has perimeter 40 m. Find dimensions giving maximum area.

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**02** An open-top box with square base has volume  $32 \text{ m}^3$ . Minimize surface area.

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**03** Split 20 into two nonnegative numbers with maximum product.

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**04** Explain why solving  $f'(x)=0$  alone does not finish an optimization problem.

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## Worked answers | Lesson 292

### Classic Calculus Optimization Problems

Watch the matching video: <https://www.youtube.com/watch?v=yZnaUnDeTQ0>

Practice focus: Optimization

Original extra practice matched to the listed lesson topic.

**01** A rectangle has perimeter 40 m. Find dimensions giving maximum area.

Let width  $x$ , length  $20-x$ .  $A=20x-x^2$ ;  $A'=20-2x=0$  at  $x=10$ . Concave down, so 10 m by 10 m maximizes area.

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**02** An open-top box with square base has volume  $32 \text{ m}^3$ . Minimize surface area.

Let base side  $x>0$ , height  $32/x^2$ .  $S=x^2+128/x$ .  $S'=2x-128/x^2=0$  gives  $x=4$  and  $h=2$ ;  $S''>0$ .

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**03** Split 20 into two nonnegative numbers with maximum product.

$P=x(20-x)$ ; vertex at  $x=10$ . Numbers 10 and 10 give maximum 100.

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**04** Explain why solving  $f'(x)=0$  alone does not finish an optimization problem.

Critical points may be minima or inadmissible. Check the domain, classify candidates and compare endpoints when relevant.