

Exercise walk-through

Solving Related Rates Problems ■ 4.5

eXercise

You must be able to

- carry out the full related-rates procedure and solve for the unknown rate

Method — Solving related rates

- 1 write the relation;
- 2 differentiate with respect to t ;
- 3 substitute the known values and rates;
- 4 solve for the unknown rate.

Method — Example

A circle's radius grows at $\frac{dr}{dt} = 2$ cm/s. At $r = 3$: $\frac{dA}{dt} = 2\pi r \frac{dr}{dt} = 2\pi(3)(2) = 12\pi$ cm²/s.

Practice 2.1 ■ 1 mark

List the steps of a related-rates solution.

Solution 2.1

Method: Solving related rates

Worked steps

write the relation; differentiate with respect to t ; substitute; solve for the unknown rate **B1**.

Practice 2.2 ■ 2 marks

A circle's r grows at 2 cm/s. At $r = 3$, find $\frac{dA}{dt}$ (with $A = \pi r^2$).

Solution 2.2

Method: Example

Worked steps

$$\frac{dA}{dt} = 2\pi(3)(2) = 12\pi \text{ cm}^2/\text{s} \quad \text{M1} \quad \text{A1}.$$

Practice 2.3 ■ 1 mark

State the units of $\frac{dA}{dt}$ here.

Solution 2.3

Worked steps

 cm^2/s **B1**.

Exam-style 3.1 ■ 1 mark

After differentiating, the next step is to

- A** stop
- B** substitute known values and solve
- C** integrate
- D** graph

Solution 3.1

- A stop
- B substitute known values and solve** 
- C integrate
- D graph

Worked steps

B.

Exam-style 3.2 ■ 1 mark

If $\frac{dr}{dt} = 2$ and $r = 3$, then $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ equals

A 6π

B 12π

C 4π

D 9π

Solution 3.2

A 6π

B 12π



C 4π

D 9π

Worked steps

B.

Exam-style 3.3 ■ 1 mark

$$A = \pi r^2, \frac{dr}{dt} = 2, r = 3.$$

(a) Write $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$.

(b) Substitute.

(c) State $\frac{dA}{dt}$.

Solution 3.3

Method: Solving related rates

Worked steps

(a) $\frac{dA}{dt} = 2\pi r \frac{dr}{dt}$ **B1**. (b) $2\pi(3)(2)$ **B1**. (c) $12\pi \text{ cm}^2/\text{s}$ **B1**.