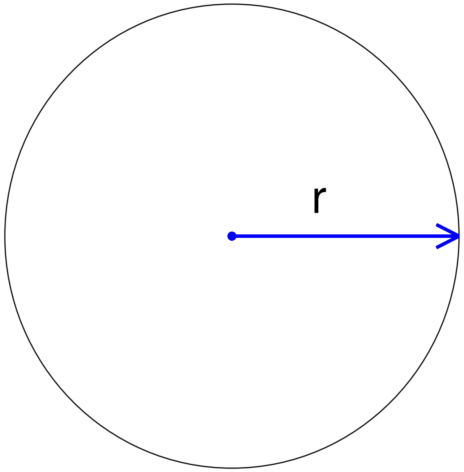
Question 1

The radius of a circle is increasing at a rate of 2 centimeters/second.

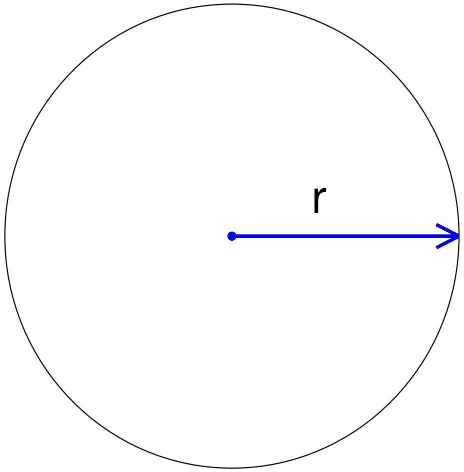


How fast is the area increasing when the radius is $10cm$?

1. $10\pi r\ cm^2/sec$
2. $20\pi r\ cm^2/sec$
3. $30\pi r\ cm^2/sec$
4. $40\pi r\ cm^2/sec$
5. $50\pi r\ cm^2/sec$
6. cannot be determined

Question 1

The radius of a circle is increasing at a rate of 2 centimeters/second.



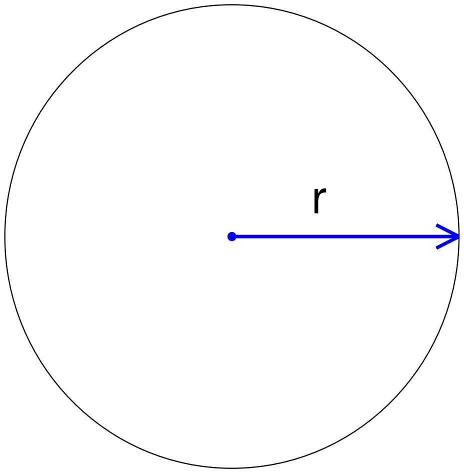
How fast is the area increasing when the radius is $10cm$?

1. $10\pi r\ cm^2/sec$
2. $20\pi r\ cm^2/sec$
3. $30\pi r\ cm^2/sec$
4. $40\pi r\ cm^2/sec$
5. $50\pi r\ cm^2/sec$
6. cannot be determined

4. $40\pi r\ cm^2/sec$.

Question 2

The radius of a circle is increasing at a rate of 4 centimeters/second.

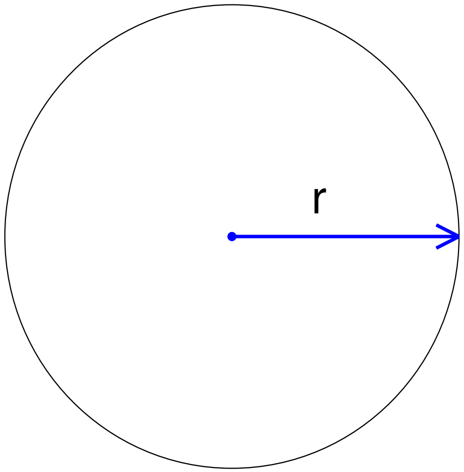


How fast is the circumference increasing?

1. $6\pi\ cm^2/sec$
2. $4\pi\ cm^2/sec$
3. $8\pi\ cm^2/sec$
4. $10\pi\ cm^2/sec$
5. $12\pi\ cm^2/sec$
6. cannot be determined

Question 2

The radius of a circle is increasing at a rate of 4 centimeters/second.



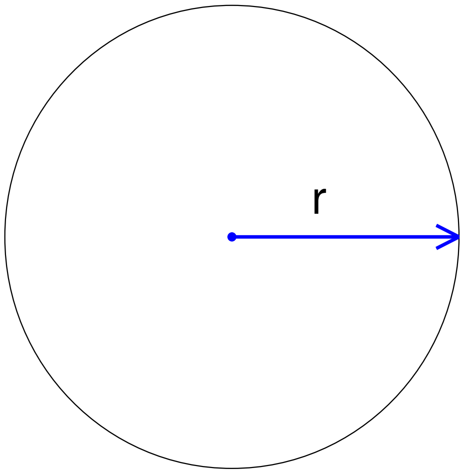
How fast is the circumference increasing?

1. $6\pi\ cm^2/sec$
2. $4\pi\ cm^2/sec$
3. $8\pi\ cm^2/sec$
4. $10\pi\ cm^2/sec$
5. $12\pi\ cm^2/sec$
6. cannot be determined

3. $8\pi\ cm^2/sec$.

Question 3

The **area** A of a circle is increasing at a rate of $4\ cm^2/sec$.

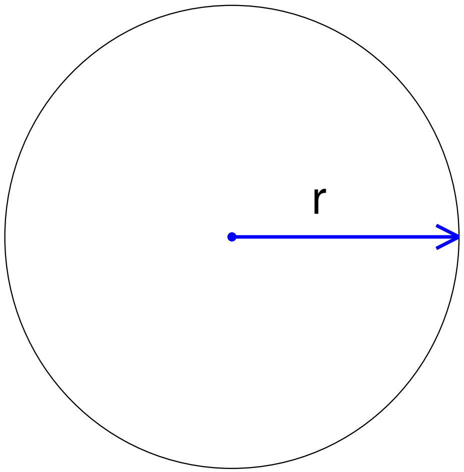


How fast is the *radius* increasing when $A = 16$?

1. $1/(8\sqrt{\pi})\ cm/sec$
2. $1/(4\sqrt{\pi})\ cm/sec$
3. $8\sqrt{\pi}\ cm/sec$
4. $10\sqrt{\pi}\ cm/sec$
5. $1/(2\sqrt{\pi})\ cm/sec$
6. cannot be determined

Question 3

The **area** A of a circle is increasing at a rate of $4\ cm^2/sec$.



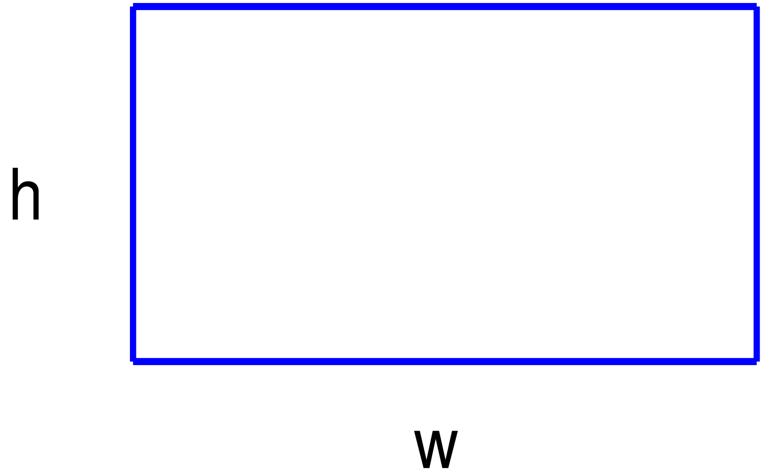
How fast is the *radius* increasing when $A = 16$?

1. $1/(8\sqrt{\pi})\ cm/sec$
2. $1/(4\sqrt{\pi})\ cm/sec$
3. $8\sqrt{\pi}\ cm/sec$
4. $10\sqrt{\pi}\ cm/sec$
5. $1/(2\sqrt{\pi})\ cm/sec$
6. cannot be determined

5. $r = \frac{\sqrt{A}}{\sqrt{\pi}}$ so $r' = \frac{1}{2\pi\sqrt{A}} \cdot A' = \frac{4}{2\pi\sqrt{16}}$

Question 4

The **width** w of a rectangle is increasing at a rate of $1\ cm/sec$.

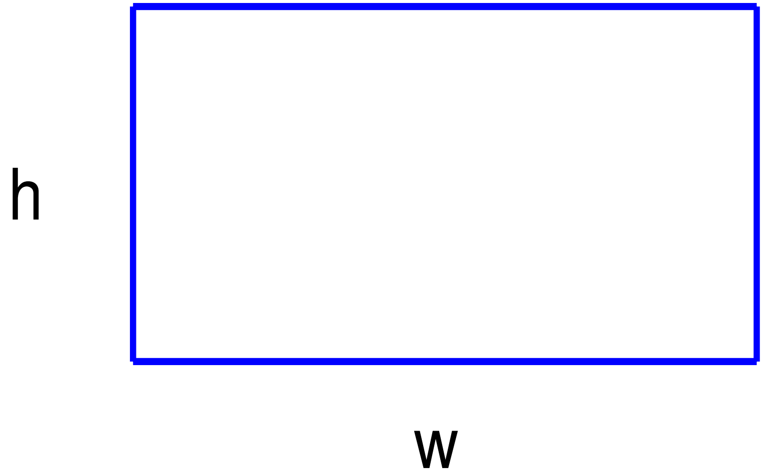


How fast is the *area* increasing if $h = 10$?

1. $6\ cm^2/sec$
2. $4\ cm^2/sec$
3. $8\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

Question 4

The **width** w of a rectangle is increasing at a rate of $1\ cm/sec$.



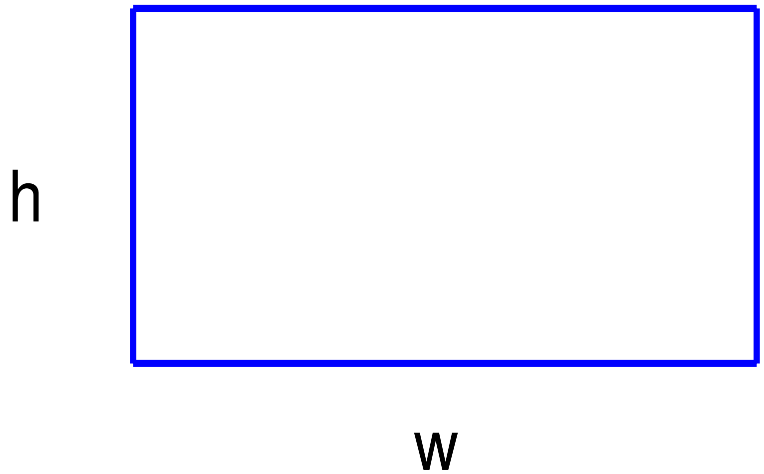
How fast is the *area* increasing if $h = 10$?

1. $6\ cm^2/sec$
2. $4\ cm^2/sec$
3. $8\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

4. $A = hw = 10w$ so $A' = 10w' = 10$

Question 5

The width w of a rectangle is increasing at a rate of $1cm/sec$ and the height is increasing at a rate of $2cm/sec$.

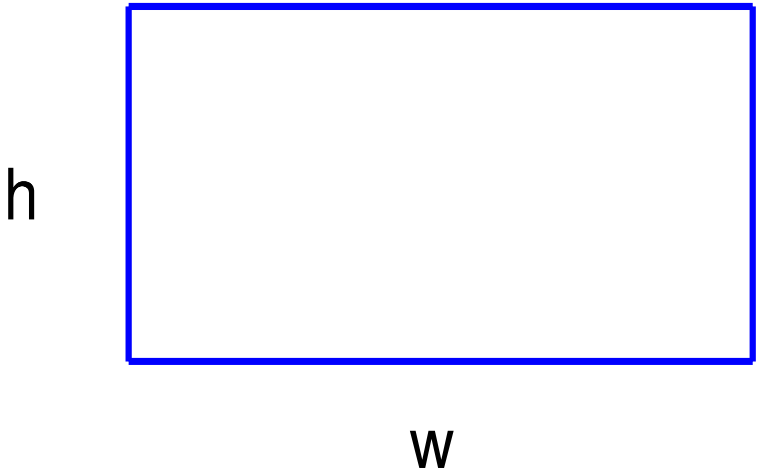


How fast is the *perimeter* increasing?

1. $6\ cm/sec$
2. $4\ cm/sec$
3. $8\ cm/sec$
4. $10\ cm/sec$
5. $12\ cm/sec$
6. cannot be determined

Question 5

The width w of a rectangle is increasing at a rate of $1cm/sec$ and the height is increasing at a rate of $2cm/sec$.



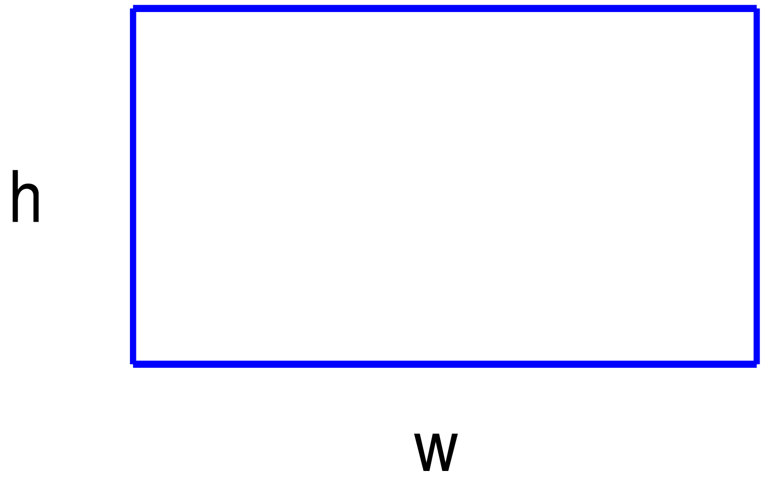
How fast is the *perimeter* increasing?

1. $6\ cm/sec$
2. $4\ cm/sec$
3. $8\ cm/sec$
4. $10\ cm/sec$
5. $12\ cm/sec$
6. cannot be determined

1. $P = 2h + 2w$ so $P' = 2h' + 2w' = 2(2) + 2(1)$

Question 6

The width w of a rectangle is increasing at a rate of $1cm/sec$ and the height is increasing at a rate of $2cm/sec$.

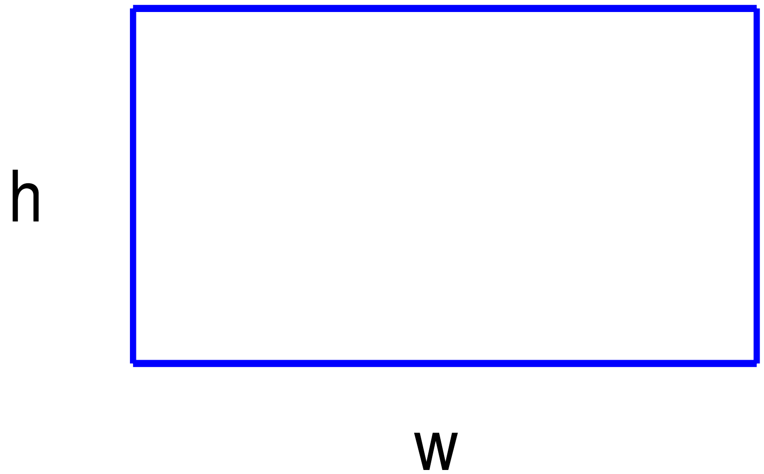


How fast is the *area* increasing?

1. $6\ cm^2/sec$
2. $4\ cm^2/sec$
3. $8\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

Question 6

The width w of a rectangle is increasing at a rate of $1cm/sec$ and the height is increasing at a rate of $2cm/sec$.



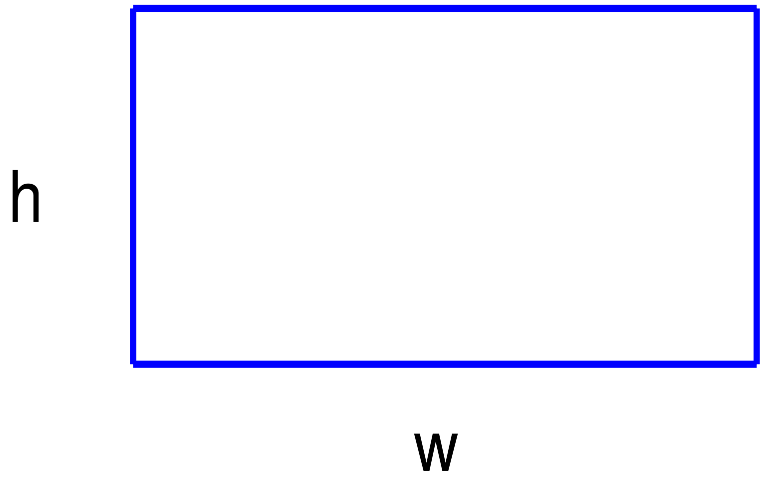
How fast is the *area* increasing?

1. $6\ cm^2/sec$
2. $4\ cm^2/sec$
3. $8\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

6. $A = hw$ so $A' = h'w + w'h$ we need to know h and w

Question 7

The width w of a rectangle is increasing at a rate of $1cm/sec$ and the height is increasing at a rate of $2cm/sec$.

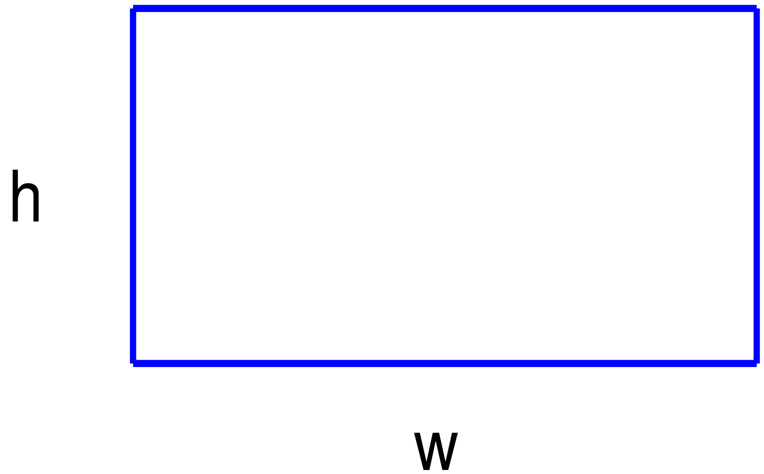


How fast is the *area* increasing when $h = 10$ and $w = 5$?

1. $30\ cm^2/sec$
2. $20\ cm^2/sec$
3. $80\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

Question 7

The width w of a rectangle is increasing at a rate of $1cm/sec$ and the height is increasing at a rate of $2cm/sec$.



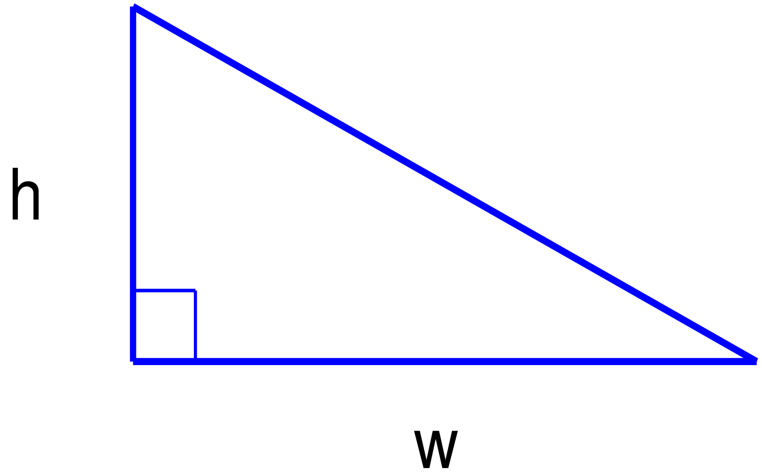
How fast is the *area* increasing when $h = 10$ and $w = 5$?

1. $30\ cm^2/sec$
2. $20\ cm^2/sec$
3. $80\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

2. $A = hw$ so $A' = h'w + w'h = (2)(5) + (1)(10)$

Question 8

The width w of a right triangle is increasing at a rate of $1cm/sec$.

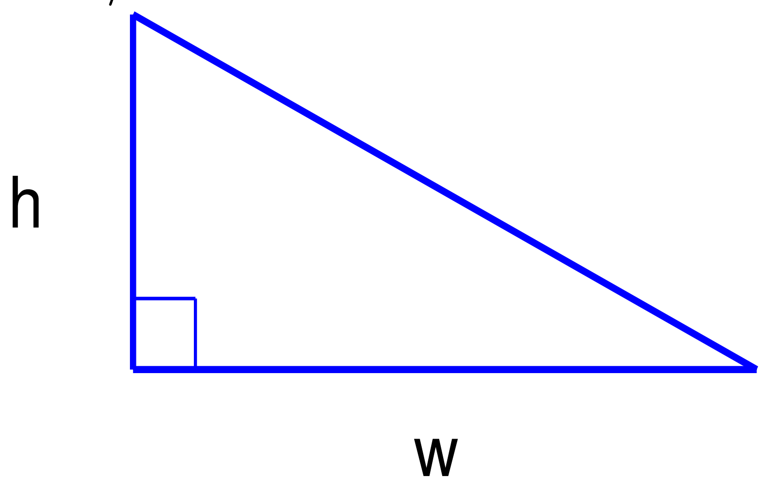


How fast is the *area* increasing?

1. $30\ cm^2/sec$
2. $20\ cm^2/sec$
3. $80\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

Question 8

The width w of a right triangle is increasing at a rate of $1cm/sec$.



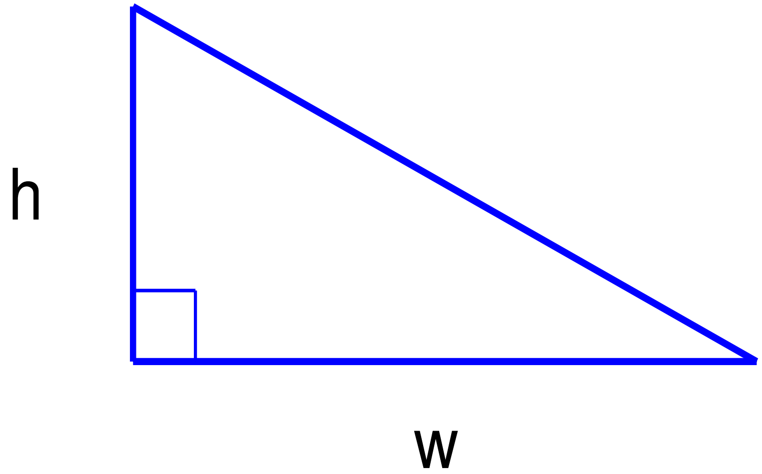
How fast is the *area* increasing?

1. $30\ cm^2/sec$
2. $20\ cm^2/sec$
3. $80\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

6. $A = \frac{1}{2}hw$ so $A' = hw' = h \cdot 1$ we need to know h

Question 9

The width w of a right triangle is increasing at a rate of $1cm/sec$.

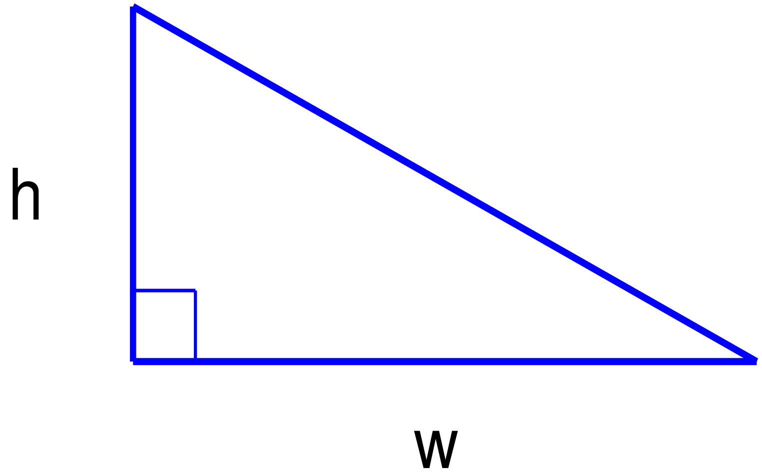


If $h = 20$, How fast is the *area* increasing?

1. $30\ cm^2/sec$
2. $20\ cm^2/sec$
3. $80\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

Question 9

The width w of a right triangle is increasing at a rate of $1cm/sec$.



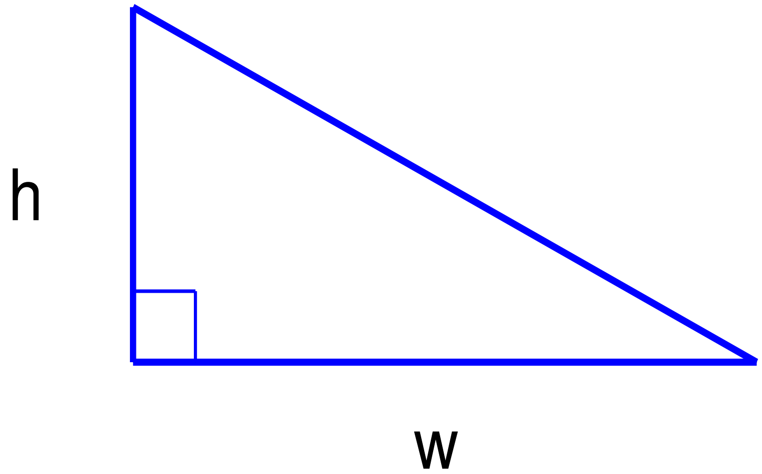
If $h = 20$, How fast is the *area* increasing?

1. $30\ cm^2/sec$
2. $20\ cm^2/sec$
3. $80\ cm^2/sec$
4. $10\ cm^2/sec$
5. $12\ cm^2/sec$
6. cannot be determined

2. $A = \frac{1}{2}hw$ so $A' = hw' = 20 \cdot 1$

Question 10

The width w of a right triangle is increasing at a rate of $2cm/sec$ and the height is decreasing at a rate of $1cm/sec$

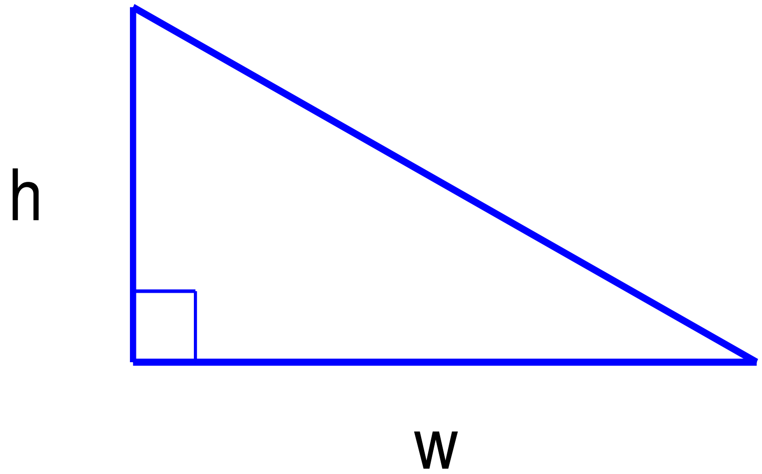


What is the rate of change of the area when $h = 4$ and $w = 6$?

1. $1\ cm^2/sec$
2. $-1\ cm^2/sec$
3. $-2\ cm^2/sec$
4. $-2\ cm^2/sec$
5. $0\ cm^2/sec$
6. cannot be determined

Question 10

The width w of a right triangle is increasing at a rate of $2cm/sec$ and the height is decreasing at a rate of $1cm/sec$



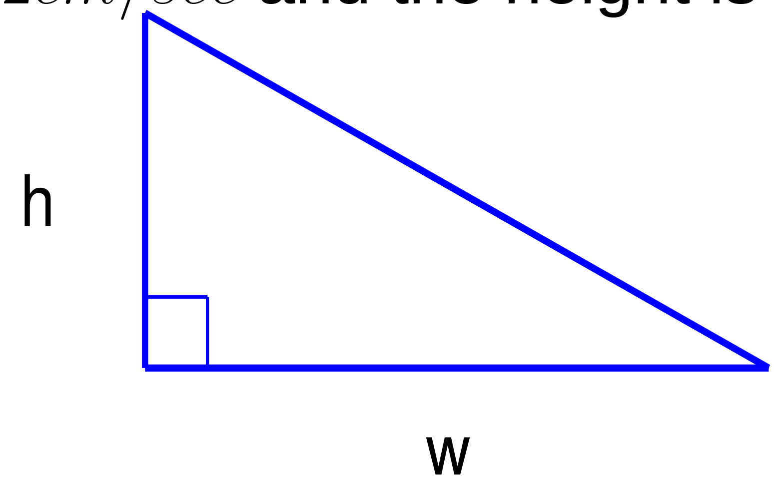
What is the rate of change of the area when $h = 4$ and $w = 6$?

1. $1\ cm^2/sec$
2. $-1\ cm^2/sec$
3. $-2\ cm^2/sec$
4. $-2\ cm^2/sec$
5. $0\ cm^2/sec$
6. cannot be determined

1. $A = \frac{1}{2}hw$ so $A' = \frac{1}{2}(h'w + w'h) = \frac{1}{2}[(-1)(6) + (2)(4)] = 1$

Question 11

The width w of a right triangle is increasing at a rate of $2cm/sec$ and the height is decreasing at a rate of $1cm/sec$

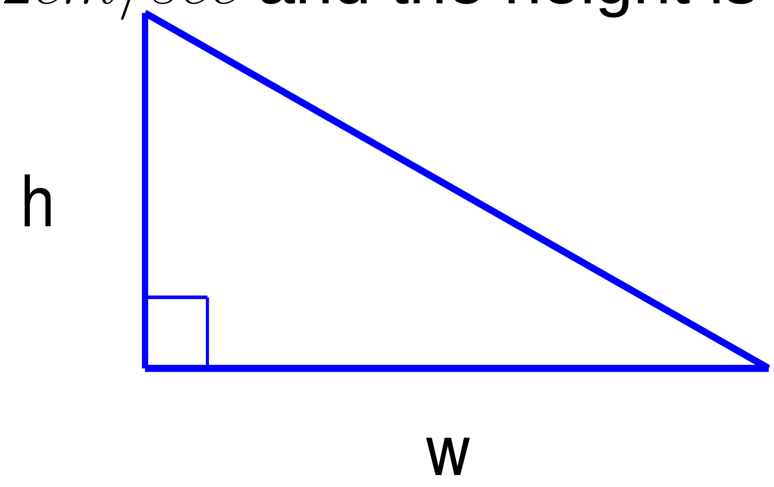


What is the rate of change of the perimeter when $h = 4$ and $w = 3$?

1. $1\ cm/sec$
2. $-1\ cm/sec$
3. $2\ cm/sec$
4. $-2\ cm/sec$
5. $0\ cm/sec$
6. cannot be determined

Question 11

The width w of a right triangle is increasing at a rate of $2cm/sec$ and the height is decreasing at a rate of $1cm/sec$



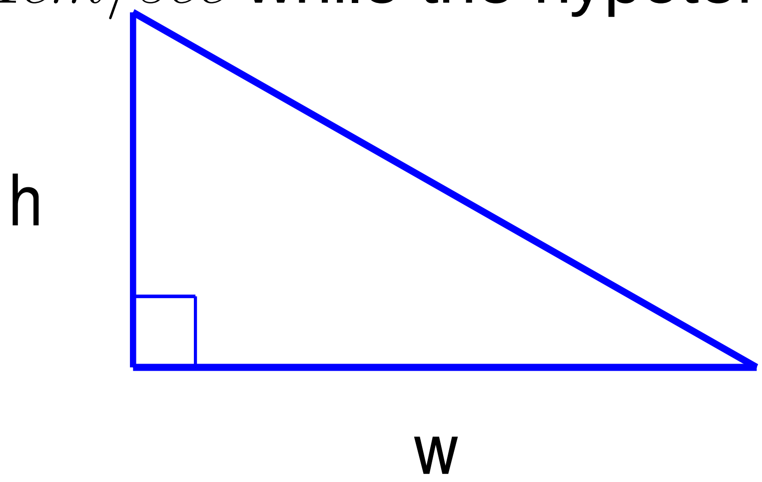
What is the rate of change of the perimeter when $h = 4$ and $w = 3$?

1. $1\ cm/sec$
2. $-1\ cm/sec$
3. $2\ cm/sec$
4. $-2\ cm/sec$
5. $0\ cm/sec$
6. cannot be determined

3. $P = h + w + \sqrt{h^2 + w^2}$ so $P' = h' + w' + \frac{2hh' + 2ww'}{2\sqrt{h^2+w^2}} = 2$

Question 12

The width w of a right triangle is increasing at a rate of $1cm/sec$ while the hypotenuse is held constant at 25.

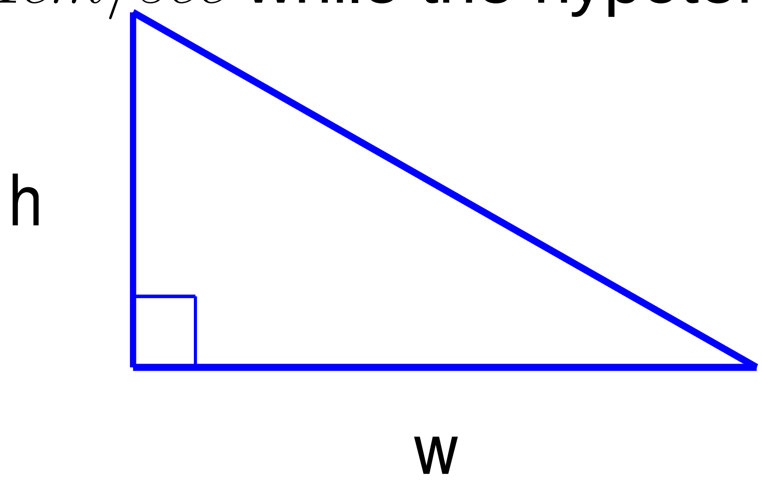


What is the rate of change of the height h when $w = 4$?

1. $2/3\ cm/sec$
2. $1/2\ cm/sec$
3. $-1/2\ cm/sec$
4. $-2/3\ cm/sec$
5. $0\ cm/sec$
6. cannot be determined

Question 12

The width w of a right triangle is increasing at a rate of $1cm/sec$ while the hypotenuse is held constant at 25.



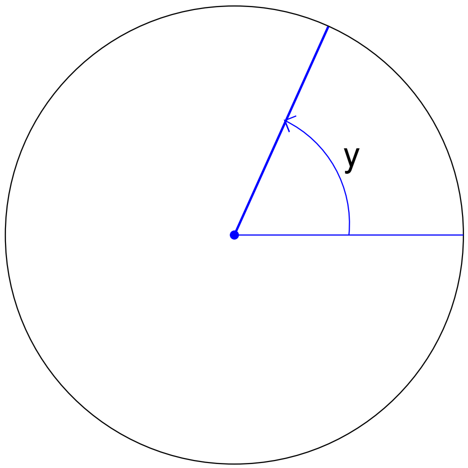
What is the rate of change of the height h when $w = 4$?

1. $2/3\ cm/sec$
2. $1/2\ cm/sec$
3. $-1/2\ cm/sec$
4. $-2/3\ cm/sec$
5. $0\ cm/sec$
6. cannot be determined

4. $h^2 + w^2 = 25$ so $h = \sqrt{25 - w^2}$ $\quad h' = \frac{-2ww'}{2\sqrt{25-w^2}} = -\frac{2}{3}$

Question 13

A line from the center to the perimeter of a circle of radius $10cm$ makes an angle y with the horizontal axis.

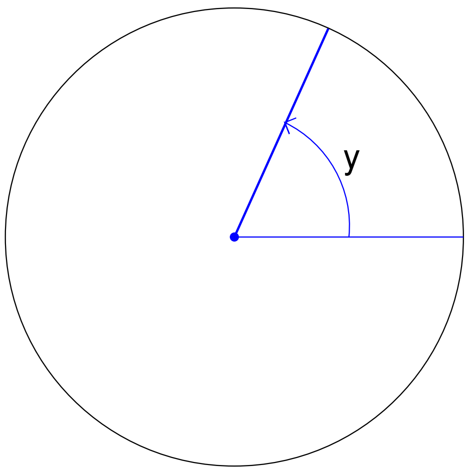


What is the rate of change of the area of the sector if y increases at $2radians/sec$?

1. $50\ cm^2/sec$
2. $20\ cm^2/sec$
3. $10\pi\ cm^2/sec$
4. $30\pi\ cm^2/sec$
5. $100\ cm^2/sec$
6. cannot be determined

Question 13

A line from the center to the perimeter of a circle of radius $10cm$ makes an angle y with the horizontal axis.



What is the rate of change of the area of the sector if y increases at $2radians/sec$?

1. $50\ cm^2/sec$
2. $20\ cm^2/sec$
3. $10\pi\ cm^2/sec$
4. $30\pi\ cm^2/sec$
5. $100\ cm^2/sec$
6. cannot be determined

5. $A = \frac{1}{2}r^2y$ so $A' = \frac{1}{2}r^2y' = \frac{1}{2} \cdot 100 \cdot 2$

Question 14

Air is forced into a spherical soap bubble in such a way that the rate of increase of the radius is $0.2 cm/sec$.

Find the rate of change of the volume V of the bubble when $r = 5cm$.

1.	$50\pi \; cm^3/sec$	4.	$30\pi \; cm^2/sec$
2.	$20\pi \; cm^3/sec$	5.	$100 \; cm^2/sec$
3.	$10\pi \; cm^3/sec$	6.	cannot be determined

Question 14

Air is forced into a spherical soap bubble in such a way that the rate of increase of the radius is $0.2cm/sec$.

Find the rate of change of the volume V of the bubble when $r = 5cm$.

1. $50\pi\ cm^3/sec$
2. $20\pi\ cm^3/sec$
3. $10\pi\ cm^3/sec$
4. $30\pi\ cm^2/sec$
5. $100\ cm^2/sec$
6. cannot be determined

2. $V = \frac{4}{3}\pi r^3$ so $V' = 4\pi r^2 \cdot r' = 4 \cdot \pi \cdot 25 \cdot (0.2)$

Question 15

Air is forced into a spherical soap bubble at a rate of $2cm^3/sec$.

Find the rate of change of the radius r of the bubble when the volume V is $100cm^3$.

1. $50\pi\ cm^3/sec$
2. $20\pi\ cm^3/sec$
3. $10\pi\ cm^3/sec$
4. $30\pi\ cm^2/sec$
5. $100\ cm^2/sec$
6. cannot be determined

Question 15

Air is forced into a spherical soap bubble at a rate of $2cm^3/sec$.

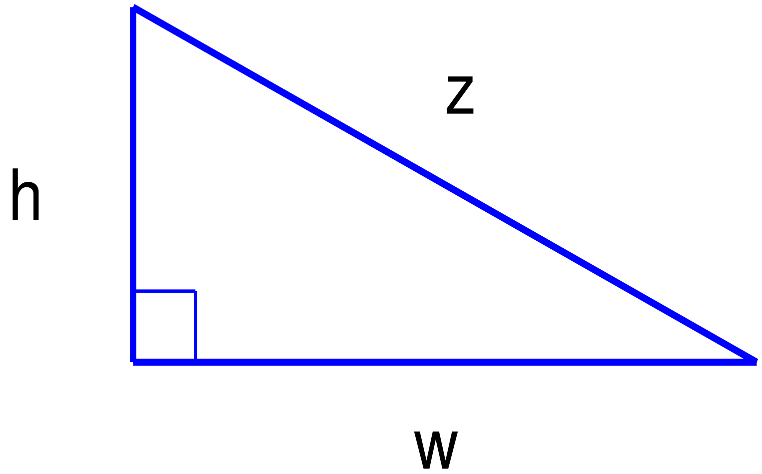
Find the rate of change of the radius r of the bubble when the volume V is $100cm^3$.

1. $50\pi\ cm^3/sec$
2. $20\pi\ cm^3/sec$
3. $10\pi\ cm^3/sec$
4. $30\pi\ cm^2/sec$
5. $100\ cm^2/sec$
6. cannot be determined

2. $V = \frac{4}{3}\pi r^3$ so $r = \sqrt[3]{\frac{3V}{4\pi}}$ and
$r' = \frac{1}{3}4\pi r^2 \cdot r' = 4 \cdot \pi \cdot 25 \cdot (0.2)$

Question 16

The width w of a right triangle is increasing at a rate of $2cm/sec$ and the height is increasing at a rate of $1cm/sec$

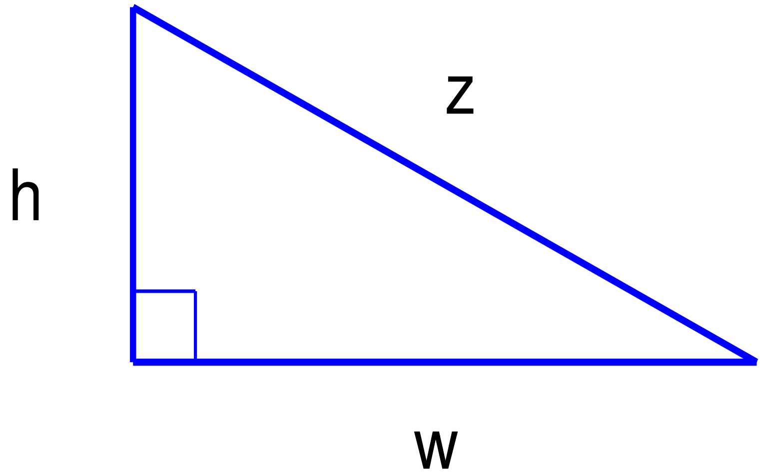


What is the rate of change of the hypotenuse z when $h = 5$ and $w = 12$?

1. $5/13\ cm/sec$
2. $15/13\ cm/sec$
3. $13/29\ cm/sec$
4. $29/13\ cm/sec$
5. $0\ cm/sec$
6. cannot be determined

Question 16

The width w of a right triangle is increasing at a rate of $2cm/sec$ and the height is increasing at a rate of $1cm/sec$



What is the rate of change of the hypotenuse z when $h = 5$ and $w = 12$?

1. $5/13\ cm/sec$
2. $15/13\ cm/sec$
3. $13/29\ cm/sec$
4. $29/13\ cm/sec$
5. $0\ cm/sec$
6. cannot be determined

3. $z = \sqrt{h^2 + w^2}$ so $z' = \frac{2hh' + 2ww'}{2\sqrt{h^2+w^2}} = \frac{29}{13}$

Question 17

Water flows into a cylindrical tank with a radius of 20 feet at a constant rate of 10 cubic feet per minute.

Find the rate at which the water level in the tank is rising.

1. $200/\pi\ ft/min$
2. $1/(40\pi)\ ft/min$
3. $10\pi\ ft/min$
4. $300\pi\ ft/min$
5. $100/\pi\ ft/min$
6. cannot be determined

Question 17

Water flows into a cylindrical tank with a radius of 20 feet at a constant rate of 10 cubic feet per minute.

Find the rate at which the water level in the tank is rising.

1. $200/\pi\ ft/min$
2. $1/(40\pi)\ ft/min$
3. $10\pi\ ft/min$
4. $300\pi\ ft/min$
5. $100/\pi\ ft/min$
6. cannot be determined

2. $V = \pi r^2 h$ so $h = \frac{V}{\pi r^2}$ and $h' = \frac{V'}{\pi r^2} = \frac{10}{400\pi}$

Question 18

A conical grain hopper over a railroad siding is constructed so that the radius of the cone at a distance h above the bottom is always $\sqrt{3} \cdot h$. When the door at the bottom is opened, grain flows out of the hopper at a constant rate of 10.8 cubic feet per minute. How fast is the depth of grain in the hopper decreasing when there are 216 cubic feet of grain in the hopper and the door at the bottom is open?

1. $2/10\sqrt[3]{\pi}\ ft^3/min$
2. $3/10\sqrt[3]{\pi}\ ft^3/min$
3. $1/10\sqrt[3]{\pi}\ ft^3/min$
4. $1/2\sqrt[3]{\pi}\ ft^3/min$
5. $1/20\sqrt[3]{\pi}\ ft^3/min$
6. cannot be determined

Question 18

A conical grain hopper over a railroad siding is constructed so that the radius of the cone at a distance h above the bottom is always $\sqrt{3} \cdot h$. When the door at the bottom is opened, grain flows out of the hopper at a constant rate of 10.8 cubic feet per minute. How fast is the depth of grain in the hopper decreasing when there are 216 cubic feet of grain in the hopper and the door at the bottom is open?

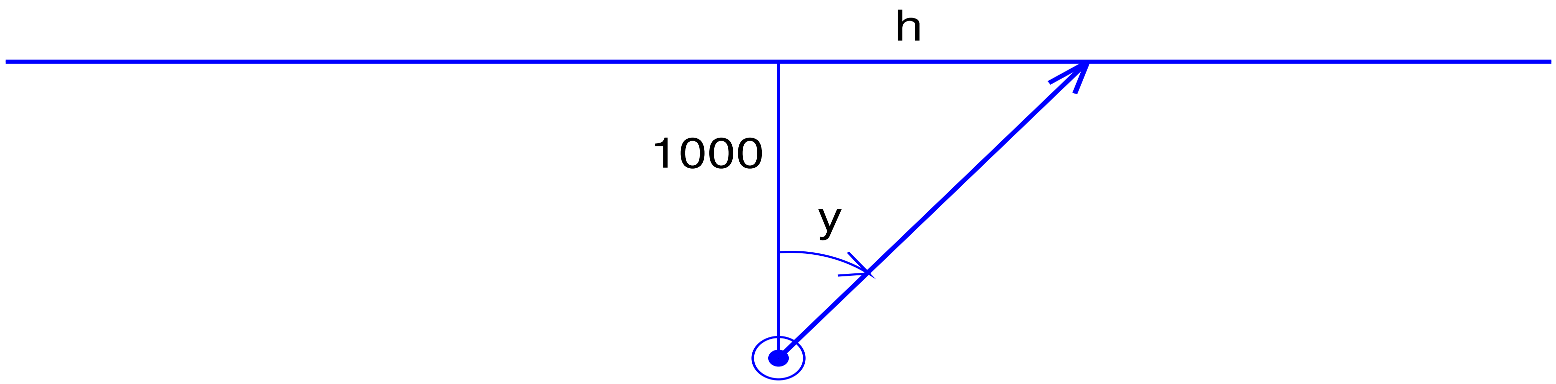
1. $2/10\sqrt[3]{\pi}\ ft^3/min$
2. $3/10\sqrt[3]{\pi}\ ft^3/min$
3. $1/10\sqrt[3]{\pi}\ ft^3/min$
4. $1/2\sqrt[3]{\pi}\ ft^3/min$
5. $1/20\sqrt[3]{\pi}\ ft^3/min$
6. cannot be determined

3. $V = \frac{1}{3}\pi r^2 h$ and $r = \sqrt{3}h$ so $V = \pi h^3$ and $h = \frac{1}{\sqrt[3]{\pi}} V^{1/3}$

so $h' = \frac{1}{\sqrt[3]{\pi}} \frac{1}{3} V^{-2/3} V' = \frac{1}{10\sqrt[3]{\pi}}$

Question 19

A lighthouse 1000 feet from shore sweeps cockwise at a rate of $2\ radians/min$.



Find the rate of change of change of h, the distance from the shore opposite the lighthouse to the beam, when $y = \pi/4$.

1. $1000\ ft/min$
2. $2000\ ft/min$
3. $3000\ ft/min$
4. $4000\ ft/min$
5. $5000\ ft/min$
6. cannot be determined

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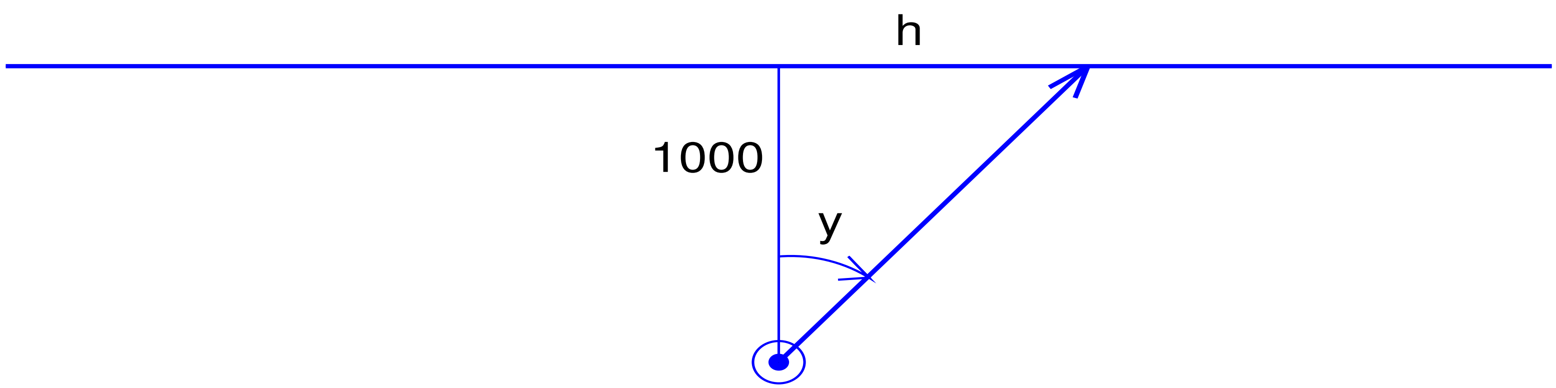

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3. $3000\ ft/min$
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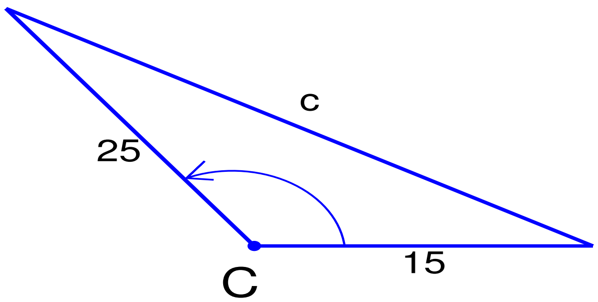
5. $5000\ ft/min$
6. cannot be determined

1. $\tan y = \frac{h}{1000}$ so $h = 1000 \tan y$ and $h' = 1000 \cdot \sec^2 y \cdot y'$

Question 20

Two sides of a triangle have lengths $15cm$ and $25cm$, while the third side varies as angle C sweeps countercockwise at a rate of $2\ radians/sec$.



Find the rate of change of change of c, the third side of the triangle, when $C = 3\pi/4$.

1. $10.98\ cm/sec$
2. $12.03\ cm/sec$
3. $9.66\ cm/sec$
4. $4.38\ cm/sec$
5. $14.27\ cm/sec$
6. cannot be determined

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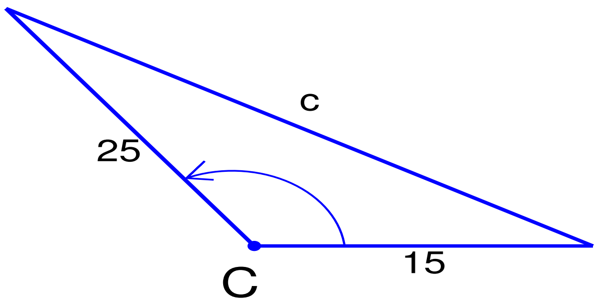

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4. $4.38\ cm/sec$
5. $14.27\ cm/sec$
6. cannot be determined

5. $c = \sqrt{15^2 + 25^2 - 2 \cdot 15 \cdot 25 \cdot \cos C}$ by the law of cosines. After some computation $c' = 14.27$