This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

001 10.0 points

Use the quadratic formula to solve

$$-61.3333 = 7\,t - \frac{5}{6}\,t^2 .$$

What is the larger of the solutions?

Correct answer: 13.752.

Explanation:

Rearranging the equation we get

$$\frac{5}{6}\,t^2 - 7\,t - 61.3333 = 0$$
$$5\,t^2 - 42\,t - 368 = 0$$

$$t = \frac{-(-42) \pm \sqrt{(-42)^2 - 4(5)(-368)}}{2(5)}$$
$$= \frac{42 \pm \sqrt{9124}}{10} ,$$

with a larger solution of

$$\frac{42 + \sqrt{9124}}{10} \approx \boxed{13.752} .$$

002 10.0 points

What is the integral of $fx=x$? Recall that the integral is the inverse of the derivative or that the derivative of $Fx = fx$ (Hint: the derivative of $x^2 = 2x$).

What is the area under fx between $x = -1$ and $x = 1$?

1. $Fx = 0.5x^2$; Area = 0 CORRECT

2. $Fx = x^2$; Area = 0

3. $Fx = x^2$; Area = 2

4. $Fx = 0.5x^2$; Area = 1

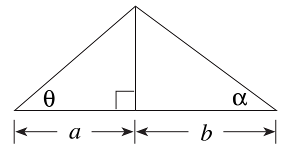
Explanation:

$Fx=0.5x^2$

Area is equal to zero since below zero the area is negative and above zero the area is positive. The two areas exactly cancel. Or if you evaluate Fx at the upper and lower limit the difference is zero.

003 10.0 points

For the given triangles, $a = 34.5$ m, $b = 25.7$ m, and $\alpha = 26.4^\circ$.

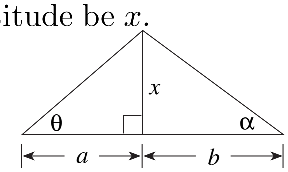


Find θ.

Correct answer: 20.2937°.

Explanation:

Let the altitude be x.



In the triangle on the right,

$$\tan\alpha = \frac{x}{b}$$
$$x = b\tan\alpha$$

and in the triangle on the left,

$$\tan\theta = \frac{x}{a} = \frac{b\tan\alpha}{a}$$
$$\theta = \arctan\left(\frac{b\tan\alpha}{a}\right)$$
$$= \arctan\left[\frac{(25.7\text{ m})\tan 26.4^\circ}{34.5\text{ m}}\right]$$
$$= \boxed{20.2937^\circ} .$$

004 (part 1 of 3) 10.0 points

Solve the system of linear equations

$$\begin{cases} x - 2y + 3z = 5 \\ 4x + 5y + z = 26 \\ -x + y - 2z = -5 \end{cases}$$

What is the value of z?

Correct answer: 3.

Explanation:

Write the system in triangular form:

$$\begin{cases} x - 2y + 3z = 5 \\ 4x + 5y + z = 26 \\ -x + y - 2z = -5 \end{cases}$$

Subtract Equation 1 × 4 from Equation 2:

$$\begin{cases} x - 2y + 3z = 5 \\ 13y - 11z = 6 \\ -x + y - 2z = -5 \end{cases}$$

Add Equation 1 to Equation 3:

$$\begin{cases} x - 2y + 3z = 5 \\ 13y - 11z = 6 \\ -y + z = 0 \end{cases}$$

Add Equation 3 × 13 to Equation 2:

$$\begin{cases} x - 2y + 3z = 5 \\ 2z = 6 \\ -y + z = 0 \end{cases}$$

Interchange Equation 2 and Equation 3:

$$\begin{cases} x - 2y + 3z = 5 \\ -y + z = 0 \\ 2z = 6 \end{cases}$$

Thus

$$\begin{aligned} 2z &= 6 \\ z &= 3\,. \end{aligned}$$

005 (part 2 of 3) 10.0 points

What is the value of y?

Correct answer: 3.

Explanation:

$$\begin{cases} y + z = 0 \\ z = 3 \end{cases}$$

Substitute z into the first equation:

$$\begin{aligned} y + 3 &= 6 \\ y &= 3\,. \end{aligned}$$

006 (part 3 of 3) 10.0 points

What is the value of x?

Correct answer: 2.

Explanation:

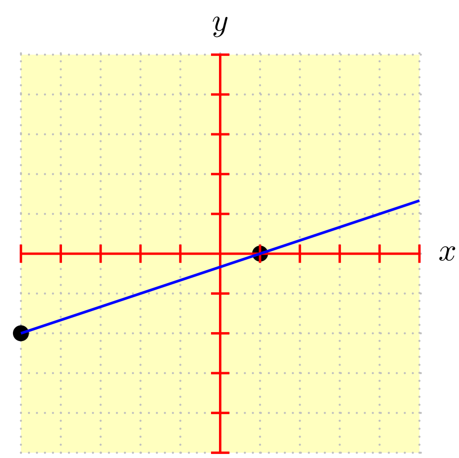
$$\begin{cases} x - 2y + 3z = 5 \\ y = 3 \\ z = 3 \end{cases}$$

Substitute into the first equation

$$\begin{aligned} x - 2(3) + 3(3) &= 5 \\ x + (3) &= 5 \\ x &= x\,. \end{aligned}$$

007 10.0 points

A graph of a straight line going through two points is shown below.



What is the equation of this line?

1. $y = \frac{1}{3}x + \frac{1}{3}$
2. $y = \frac{1}{3}x + 1$
3. $y = \frac{1}{3}x - \frac{1}{3}$ **correct**
4. $y = \frac{-1}{3}x - \frac{1}{3}$
5. $y = 3\,x - \frac{1}{3}$

6. $y = 3\,x - 1$

7. $y = -3\,x + \dfrac{1}{3}$

8. $y = \dfrac{-1}{3}\,x + 1$

9. $y = \dfrac{1}{3}\,x - 1$

10. $y = -3\,x - \dfrac{1}{3}$

Explanation:

$$\begin{aligned} \text{Let :} \quad & (x_1, y_1) = (-5, -2) \\ & (x_2, y_2) = (1, 0)\,. \end{aligned}$$

The slope is

$$m = \frac{(0) - (-2)}{(1) - (-5)} = \frac{1}{3}\,.$$

Using 2 points

$$\begin{aligned} (y - y_1) &= m(x - x_1) \\ y &= m(x - x_1) + y_1 \end{aligned}$$

Therefore,

$$\begin{aligned} y &= \frac{1}{3}(x + 5) - 2 \\ &= \frac{1}{3}\,x - \frac{1}{3}\,. \end{aligned}$$

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008 10.0 points

Find the derivative $f'(x)$ for

$$f(x) = 2x^2 + x - 1$$

starting from first principles.

1. $2x + 1$

2. $2x - 1$

3. Does not exist

4. $4x - 1$

5. $4x + 1$ **correct**

Explanation:

$$f(x) = 2x^2 + x - 1$$

and

$$\begin{aligned} f(x + \Delta x) &= 2(x + \Delta x)^2 \\ &\quad + (x + \Delta x) - 1 \\ &= 2[x^2 + 2x\Delta x + (\Delta x)^2] \\ &\quad + x + \Delta x - 1 \end{aligned}$$

Consider

$$\begin{aligned} f(x + \Delta x) - f(x) &= [2x^2 + 4x\Delta x + 2(\Delta x)^2 \\ &\quad + x + \Delta x - 1] \\ &\quad - (2x^2 + x - 1) \\ &= 4x\Delta x + 2(\Delta x)^2 + \Delta x \end{aligned}$$

so that

$$\frac{f(x + \Delta x) - f(x)}{\Delta x} = 4x + 2\Delta x + 1$$

and this limit exists as $\Delta x \to 0$, so

$$\begin{aligned} f'(x) &= \lim_{\Delta x \to 0} \frac{f(x + \Delta x) - f(x)}{\Delta x} \\ &= \lim_{\Delta x \to 0} (4x + 2\Delta x + 1) \\ &= 4x + 1\,. \end{aligned}$$