

**Question 1:** Find an equation of the tangent line to the curve

$$x^2 + y^2 = (2x^2 + 2y^2 - x)^2$$

at the point  $(0, 1/2)$ .

[5]

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**Question 2:** Find  $y''$  by implicit differentiation if

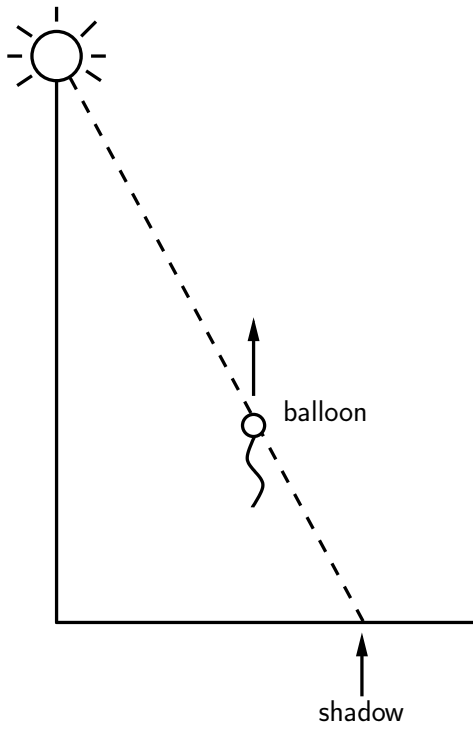
$$x^3 + y^3 = 1$$

Express your answer as a single simplified fraction involving the variables  $x$  and  $y$  only.

[5]

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**Question 3:** A balloon is released from ground level 4 m from the base of a 12 m tall lamppost. As the balloon rises vertically it casts a shadow on the ground as a result of the light atop the lamppost. When the balloon is 3 m above the ground it is rising at 1 m/s. At what rate is the shadow moving along the ground at that same instant?



**Question 4:** Use a linear approximation to approximate  $\sqrt{26}$ .

[5]

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**Question 5:** The circumference of a sphere was measured to be 100 cm with a possible measurement error of  $1/2$  cm. Estimate the maximum error in the calculated surface area.  
(Note: the surface area of a sphere of radius  $r$  is  $S = 4\pi r^2$ .)

[5]

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**Question 6:**

(a) Find the domain of  $f(x) = \frac{x}{1 - e^{x-2}}$

**[3]**

(b) Find the limit:  $\lim_{x \rightarrow 3^-} e^{5/(3-x)}$

**[3]**

(c) Express as a single simplified logarithm:

$$\frac{1}{3} \ln(x+2)^3 + \frac{1}{2} [\ln x - \ln(x^2 + 3x + 2)^2]$$

**[4]**

**Question 7:** Find the following derivatives (it is not necessary to simplify your answers):

(a)  $y = \sqrt{1 + 2e^{3x}}$

[2]

(b)  $f(x) = 10^{1-x^2}$

[2]

(c)  $y = x^2 \ln(2x + 1)$

[3]

(d)  $g(t) = [\ln(1 + e^{3t})]^2$

[3]