



Instructor: Dr. R.A.G. Seely  
(Apr 2019)

Quiz 4

## Calculus I (Maths 201–NYA)

### (With Answers)

**Justify** all your answers—just having the correct answer is not sufficient.

Do 1(a) and 2(a) now. The rest are to be done at home, and handed in next Wednesday, at the start of class. (No late submissions accepted.) You will find a copy of this quiz on my webpage, so you don't need to copy the extra questions now.

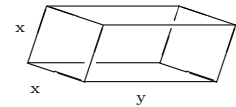
1. Sketch the following, including all relevant information about intercepts, asymptotes, increasing, decreasing, extrema, concavity, inflection.

(NOW:) (a)  $y = 5x^3 - 3x^5$

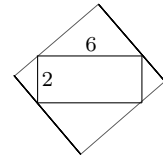
(AT HOME:) (b)  $y = x^{5/3} - 5x^{2/3}$  (c)  $y = x\sqrt{2 - x^2}$

(d)  $y = \cos^2 x - 2 \sin x$  (e)  $y = x^2 e^x$

- (NOW:) 2. (a) A box-shaped wire frame is made from a wire 1800 cm long (by cutting it into pieces to make the frame): the frame is supposed to consist of two identical squares, connected by four straight pieces of equal length (as shown at right). What should the dimensions of the box be in order to maximize the volume?

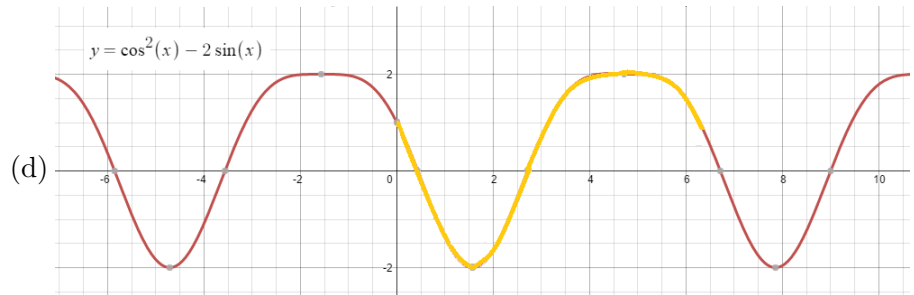
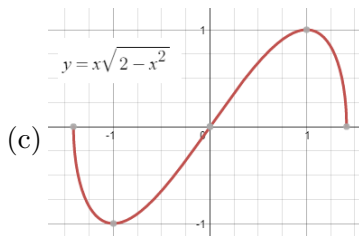
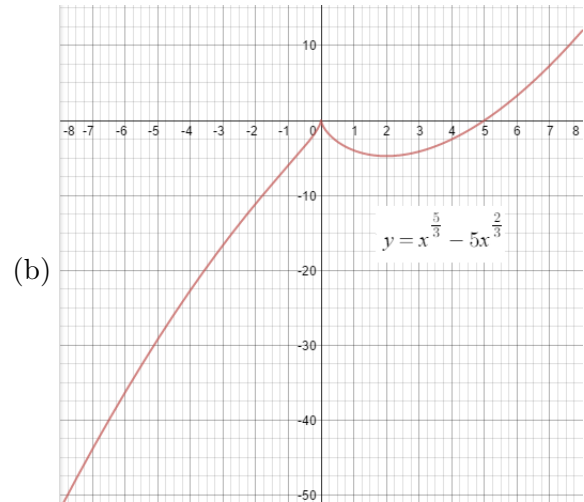
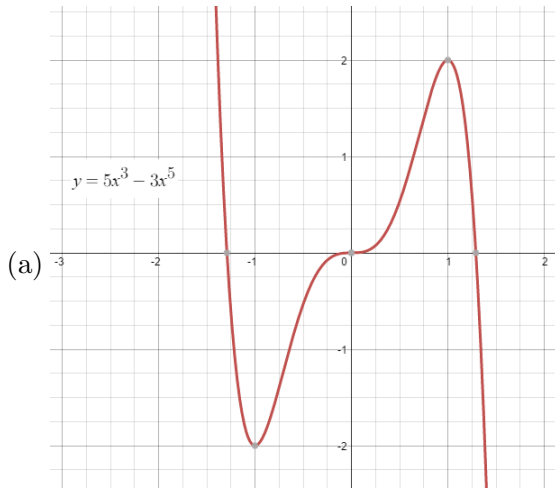


- (AT HOME:) (b) Find the maximum area of a rectangle that can be circumscribed about a (fixed) rectangle of length 6 and width 2.



Answers

1. Graphs as shown



Key data:

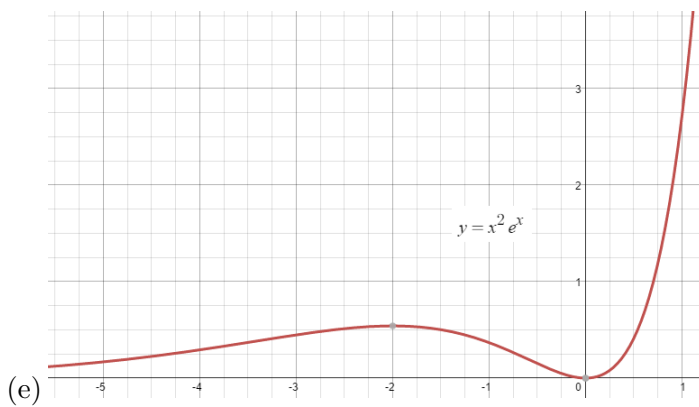
(a)  $x$ -int:  $0, \pm\sqrt{5/3}$ ;  $y$ -int:  $0$   
 No VA, HA.  
 CP:  $x = 0, \pm 1$ , PPI:  $x = 0, \pm \frac{1}{\sqrt{2}}$

(b)  $x$ -int:  $0, 5$ ;  $y$ -int:  $0$   
 No VA, HA.  
 Vertical Tangent at  $x = 0$ ,  
 CP:  $x = 0, 2$ , PPI:  $x = 0, -1$

(c)  $x$ -int:  $0, \pm\sqrt{2}$ ;  $y$ -int:  $0$   
 No VA, HA. Domain:  $[-\sqrt{2}, \sqrt{2}]$ ,  
 CP:  $x = \pm 1$ , ( $\pm\sqrt{2}$  endpoints),  
 PPI:  $x = 0$  ( $\pm\sqrt{3}$  not in domain)

(d)  $x$ -int:  $\sin^{-1}(\sqrt{2}-1) \cong 0.43$ ,  
 $\pi - \sin^{-1}(\sqrt{2}-1) \cong 2.73$  (etc).  
 $y$ -int:  $1$

No VA, HA. Periodic, period  $2\pi$ ,  
 CP:  $x = \frac{\pi}{2}, \frac{3\pi}{2}$  (etc),  
 PPI:  $x = \frac{\pi}{6}, \frac{5\pi}{6}, \frac{3\pi}{2}$  (etc).



2. (a)  $V = x^2(450 - 2x)$ ;  
 the box is a cube, sides of 150cm.  
 (b)  $A = 40 \sin \theta \cos \theta + 12$ ;  
 the rectangle is a square, area = 32.

(e)  $x$ -int:  $0$ ;  $y$ -int:  $0$   
 No VA, HA:  $y = 0$  (as  $x \rightarrow -\infty$ ),  
 CP:  $x = 0, -2$ , PPI:  $x = -2 \pm \sqrt{2}$