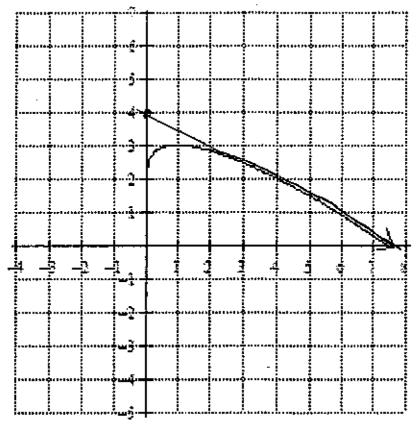
Pictured to the right is the graph of the function $g(x) = 2\sqrt{x} - x + 2$. Use the graph and the equation to answer questions 5 – 9.



5. Based on the graph, at what value(s) does the graph of $g(x)$ have a horizontal tangent? Give a reason. Show an algebraic analysis that supports your answer.

$g'(x) = x^{-1/2} - 1 = 0$

$x^{-1/2} = 1$

$\frac{1}{x^{1/2}} = 1$

$1^2 = x^2$

$x = 1$

$g'(x)$ pos | neg
1

6. On what interval(s) is $g'(x) < 0$? Give a reason for your answer.

g is dec on the interval $(1, \infty)$ cuz $g'(x) < 0$

7. On what interval(s) is $g'(x) > 0$? Give a reason for your answer.

g is inc on the interval $(0, 1)$ cuz $g'(x) > 0$

8. For what value(s) of x is the slope of the tangent line equal to 2? Show your work.

$(3, 2)$ $m = -3$

$g(x) = 2\sqrt{x} - x + 2$

$g(x) = 2(x)^{\frac{1}{2}} - x + 2$

9. Find an equation of the tangent line drawn to the graph of $g(x)$ when $x = 4$. Then, draw the tangent line on the grid above.

$g'(4) = 4^{-1/2} - 1 = -.5$

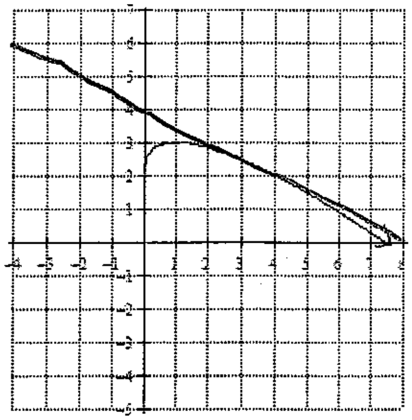
$g(4) = 2\sqrt{4} - 4 + 2 = 2$

$y - 2 = -.5(x - 4)$

$y - 2 = -.5x + 2$

$y = -.5x + 4$

Pictured to the right is the graph of the function $g(x) = 2\sqrt{x} - x + 2$. Use the graph and the equation to answer questions 5 – 9.



5. Based on the graph, at what value(s) does the graph of $g(x)$ have a horizontal tangent? Give a reason. Show an algebraic analysis that supports your answer.

$g'(x) = x^{-1/2} - 1$

$g'(x) = 0 \Rightarrow x^{-1/2} - 1 = 0$

$+1 \quad +1$

$x^{-1/2} = 1$

$\sqrt{x} \cdot \frac{1}{\sqrt{x}} = 1\sqrt{x}$

$(1)^2 = (\sqrt{x})^2$

$x = 1$

6. On what interval(s) is $g'(x) < 0$? Give a reason for your answer.

g(x) dec: (1, ∞) cuz g(x) slope is negative.

7. On what interval(s) is $g'(x) > 0$? Give a reason for your answer.

g(x) inc: (0, 1) cuz g(x) slope is positive

8. For what value(s) of x is the slope of the tangent line equal to 2? Show your work.

$x^{-1/2} - 1 = 2$

$\frac{1}{\sqrt{x}} - 1 = 2$

$+1 \quad +1$

$\frac{1}{\sqrt{x}} = 3$

$\frac{1}{3} = \frac{3\sqrt{x}}{3}$

$\left(\frac{1}{3}\right)^2 = (\sqrt{x})^2$

$x = \frac{1}{9}$

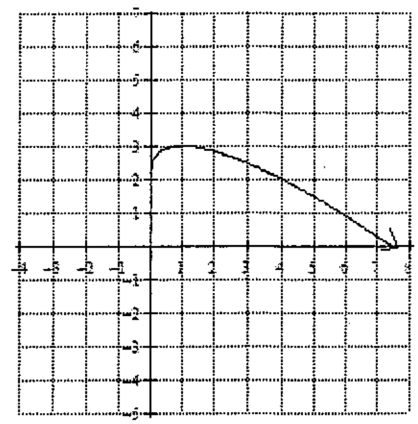
9. Find an equation of the tangent line drawn to the graph of $g(x)$ when $x = 4$. Then, draw the tangent line on the grid above.

$g(4) = 2\sqrt{4} - 4 + 2$ $\quad y = 2$

$m = -.5$

$y - 2 = -\frac{1}{2}(x - 4)$

Pictured to the right is the graph of the function $g(x)=2\sqrt{x}-x+2$. Use the graph and the equation to answer questions 5 – 9.



5. Based on the graph, at what value(s) does the graph of $g(x)$ have a horizontal tangent? Give a reason. Show an algebraic analysis that supports your answer.

Horizontal Tangent at $x=1$ because $g'(x)=0$

$g(x)=2(x)^{1/2}-x+2$

$g'(x)=x^{-1/2}-1$

$g'(x)=0 \Rightarrow x^{-1/2}-1=0$

$x^{-1/2}=1$

$\frac{1}{\sqrt{x}}=1$

$\sqrt{x}^2=1^2$

$x=1$

6. On what interval(s) is $g'(x)<0$? Give a reason for your answer.

$g'(x)<0$ on the interval $(1,\infty)$ because f is decreasing

7. On what interval(s) is $g'(x)>0$? Give a reason for your answer.

$g'(x)>0$ on the interval $(0,1)$ because f is increasing

8. For what value(s) of x is the slope of the tangent line equal to 2? Show your work.

$g(x)=2\sqrt{x}-x+2$

$g'(x)=1(x)^{-1/2}-1$

$g'(x)=x^{-1/2}-1$

$g'(x)=2=x^{-1/2}-1$

$3=x^{-1/2}$

$3=\frac{1}{\sqrt{x}}$

$3\sqrt{x}=1$

$\sqrt{x}^2=\frac{1}{3}^2$

$x=\left(\frac{1}{3}\right)^2$

$\boxed{x=\frac{1}{9}}$

9. Find an equation of the tangent line drawn to the graph of $g(x)$ when $x=4$. Then, draw the tangent line on the grid above.

$g'(4)=4^{-1/2}-1=-.5$

$g(4)=2\sqrt{4}-4+2=2$

$y-2=-.5(x-4)$

$y-2=-.5x+2$

$y=-.5x+4$

The table of values below represents values on the graph of the derivative, $h'(x)$, of a polynomial function $h(x)$. The zeros indicated in the table are the only zeros of the graph of $h'(x)$. Use the table to answer questions 10 – 15.

pos   neg   neg

x	-8	-5	-2	0	3	5	7	10	12
$h'(x)$	11	5	0	-1	-3	-1	0	-3	-9

10. On what interval(s) is the function $h(x)$ increasing and decreasing? Give reasons for your answers.

h(x) is increasing on interval (-8,-2) because h' is positive
h(x) is decreasing on interval (-2,7)U(7,12) because h' is negative

11. At what x – value(s) does the graph of $h(x)$ have a relative maximum? Justify your answer.

h(x) has RMAX @ x=-2 bc h' changes from + to -

12. At what x – value(s) does the graph of $h(x)$ have a relative minimum? Justify your answer.

h(x) has no RMIN bc h' doesn't change from neg to pos

13. If $h(3) = 2$, what is the equation of the tangent line to the graph of $h(x)$ at $x = 3$? What is the equation of the normal line to the graph of $h(x)$ at $x = 3$?

tan: $y-2=-3(x-3)$ $Y=-3x+11$

Norm: $y-2=\frac{1}{3}(x-3)$ $Y=\frac{1}{3}x+1$

14. Find the tangent line approximation of $h(3.1)$.

$y-2=-3(3.1-3)$

$y=-3(.1)+2$

$y=-.3+2$ $y=1.7$

15. Find the value of each of the following limits:

$\lim_{x\to-\infty} h(x) = -\infty$ $\lim_{x\to\infty} h(x) = -\infty$

The table of values below represents values on the graph of the derivative, $h'(x)$, of a polynomial function $h(x)$. The zeros indicated in the table are the only zeros of the graph of $h'(x)$. Use the table to answer questions 10 – 15.

x	−8	−5	−2	0	3	5	7	10	12
$h'(x)$	11	5	0	−1	−3	−1	0	−3	−9

10. On what interval(s) is the function $h(x)$ increasing and decreasing? Give reasons for your answers.

– h(x) increases (-8,-2) b/c h'(x) values = +

– h(x) decreases (-2, ∞) b/c h'(x) values = –

11. At what x – value(s) does the graph of $h(x)$ have a relative maximum? Justify your answer.

RMAX @ x=2 b/c that is where h'(x) goes from + → – values @ x = -2

12. At what x – value(s) does the graph of $h(x)$ have a relative minimum? Justify your answer.

From what we are given there isn't a minimum b/c h'(x) doesn't have any values that go from – → +

13. If $h(3) = 2$, what is the equation of the tangent line to the graph of $h(x)$ at $x = 3$? What is the equation of the normal line to the graph of $h(x)$ at $x = 3$?

$y - 2 = m(x-3)$

$\boxed{y - 2 = -3(x-3)}$ TL

$\boxed{y - 2 = \frac{1}{3}(x-3)}$ NL

14. Find the tangent line approximation of $h(3.1)$.

15. Find the value of each of the following limits:

$\lim_{x \to -\infty} h(x)$ $\lim_{x \to \infty} h(x)$

The table of values below represents values on the graph of the derivative, $h'(x)$, of a polynomial function $h(x)$. The zeros indicated in the table are the only zeros of the graph of $h'(x)$. Use the table to answer questions 10 – 15.

x	−8	−5	−2	0	3	5	7	10	12
$h'(x)$	11	5	0	−1	−3	−1	0	−3	−9

10. On what interval(s) is the function $h(x)$ increasing and decreasing? Give reasons for your answers.

(-8,-2) it is increasing cuz h'(x) is positive from the interval (-8,-2) h'>0

(-2,7)U(7,12) it is dec cus h'(x) is - from (-2,7)U(7,12) h'<0

11. At what x – value(s) does the graph of $h(x)$ have a relative maximum? Justify your answer.

h(x) has an RMax @ x = -2 cuz h' changes from + to −

12. At what x – value(s) does the graph of $h(x)$ have a relative minimum? Justify your answer.

no ~~R~~min cuz h' doesn't change from - to +

13. If $h(3) = 2$, what is the equation of the tangent line to the graph of $h(x)$ at $x = 3$? What is the equation of the normal line to the graph of $h(x)$ at $x = 3$?

$y - 2 = -3(x - 3)$

$y - 2 = 1/3\,(x - 3)$

14. Find the tangent line approximation of $h(3.1)$.

$y - 2 = -3(3.1 - 3)$

$y - 2 = -3(.1)$

$y - 2 = -.3$

$h(3.1) = 1.7$

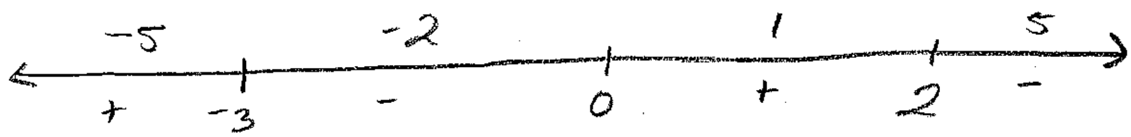
15. Find the value of each of the following limits:

$\lim_{x\to-\infty} h(x) = -\infty$ $\qquad$ $\lim_{x\to\infty} h(x) = -\infty$

The derivative of a polynomial function, $f(x)$, is given by the equation $f'(x) = x(2-x)(x+3)$. Use this equation to answer questions 16 – 20.

$x = 0 \quad x = -3 \quad x = 2$

16. On what intervals is $f(x)$ increasing? Decreasing? Justify your answers.



f is inc on the int $(-\infty, -3) \cup (0, 2)$ b/c $f(x)$ is pos

f is dec on the int $(-3, 0) \cup (2, \infty)$ b/c $f(x)$ is neg

17. At what value(s) of x does the graph of $f(x)$ reach a relative minimum? Justify your answers.

f has a LMIN @ $x = 0$ b/c f' changes from neg to pos

18. At what value(s) of x does the graph of $f(x)$ reach a relative maximum? Justify your answers.

f has a LMAX @ $x = -3, 2$ b/c f changes from pos to neg

19. If $f(4) = -1$, what is the equation of the tangent line drawn to the graph of $f(x)$ at $x = 4$?

$f'(4) = 4(2-4)(4+3)$

$f'(4 = -56$

$y - (-1) = -56(x-4)$

20. Approximate the value of $f(4.1)$. Explain why this is a good approximation of the true value of $f(4.1)$.

The derivative of a polynomial function, $f(x)$, is given by the equation $f'(x) = x(2-x)(x+3)$. Use this equation to answer questions 16 – 20.

16. On what intervals is $f(x)$ increasing? Decreasing? Justify your answers.

f inc. $(-\infty, -3)$ + $(0, 2)$; cuz $f' > 0$

f dec. $(-3, 0)$ + $(2, \infty)$; cuz $f' < 0$

+ − + −
−3 0 2

OR

F inc $(0, 2)$ b/c $f' > 0$

F dec $(-\infty, 0) \cup (2, \infty)$ b/c $f' < 0$

17. At what value(s) of x does the graph of $f(x)$ reach a relative minimum? Justify your answers.

f has a LMin at $x = 0$; cuz f' changes from (−) to (+)

18. At what value(s) of x does the graph of $f(x)$ reach a relative maximum? Justify your answers.

f has a LMax at $x = 2$; cuz f' changes from (+) to (−)

19. If $f(4) = -1$, what is the equation of the tangent line drawn to the graph of $f(x)$ at $x = 4$?

$y - {-1} = 56(x-4)$

$\boxed{y = 56(x-4) - 1}$

$y = -56(x-4) - 1$

$f'(4) = 4(2-4)(4+3)$

$f'(4) = -56$

$y + 1 = -56(x-4)$

$y = -56x + 223$

20. Approximate the value of $f(4.1)$. Explain why this is a good approximation of the true value of $f(4.1)$.

$y - (-1) = -56(4.1 - 4)$

$y - (-1) = -5.6$

$\quad\quad -1$

$\boxed{y = -6.6}$

This is a good approximation b/c 4 & 4.1 are very close in value.

The derivative of a polynomial function, $f(x)$, is given by the equation $f'(x) = x(2-x)(x+3)$. Use this equation to answer questions 16 – 20.

16. On what intervals is $f(x)$ increasing? Decreasing? Justify your answers.

$x(2-x)(x+3)=0$

$x=0 \quad x=2 \quad x=-3$

$f'(x)$ pos -3 neg 0 pos 2 neg

5 2 1 4

f is inc on $(-\infty,-3)\cup(0,2)$ cuz $f'>0$

f is dec on $(-3,0)\cup(2,\infty)$ cuz $f'<0$

17. At what value(s) of x does the graph of $f(x)$ reach a relative minimum? Justify your answers.

RMIN @ $x=0$ f' changes from $-$ to $+$

18. At what value(s) of x does the graph of $f(x)$ reach a relative maximum? Justify your answers.

RMAX @ $x=-3, 2$ f' changes from $+$ to $-$

19. If $f(4) = -1$, what is the equation of the tangent line drawn to the graph of $f(x)$ at $x = 4$?

$y-(-1)=-56(x-4)$

$f'(4)=4(2-4)(4+3)$

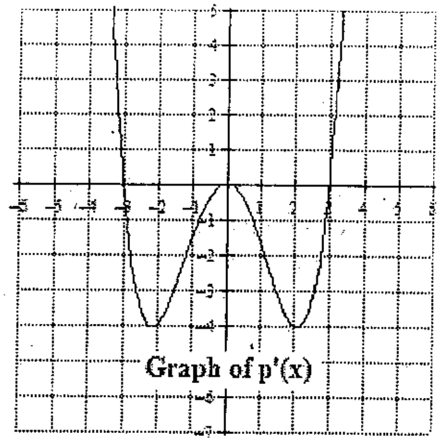
$f'(4)=-56$

20. Approximate the value of $f(4.1)$. Explain why this is a good approximation of the true value of $f(4.1)$.

$y+1=-56(4.1-4)$

$y=-6.6$

Pictured to the right is a graph of $p'(x)$, the derivative of a polynomial function, $p(x)$. Use the graph to answer the questions 21 – 25.



21. On what interval(s) is the graph of $p(x)$ decreasing? Justify your answer.

$(-3,0)\cup(0,3)$ $\quad p'<0$

22. On what interval(s) is the graph of $p(x)$ increasing? Justify your answer.

$(-\infty,-3)\cup(3,\infty)$ $\quad p'>0$

23. At what value(s) of x does the graph of $p(x)$ reach a relative maximum? Justify your answer.

$x=-3$ cuz p' changes from + to −

24. At what value(s) of x does the graph of $p(x)$ reach a relative minimum? Justify your answer.

$x=3$ cuz p' changes from − to +

25. Approximate the value of $p(1.8)$ using the tangent line approximation if $p(2) = -3$.

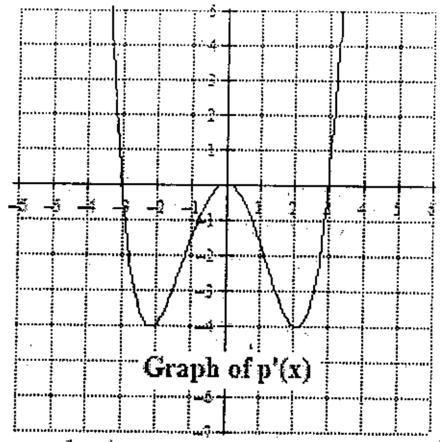
$y+3=-4(x-2)$

$y+3=-4(1.8-2)$

$y+3=.8$
$\;\;-3\;\;\;-3$

$\boxed{y=-2.2}$

Pictured to the right is a graph of $p'(x)$, the derivative of a polynomial function, $p(x)$. Use the graph to answer the questions 21 – 25.



21. On what interval(s) is the graph of $p(x)$ decreasing? Justify your answer.

P is decreasing on the interval $(-3,0)\cup(0,3)$

$p' < 0$

22. On what interval(s) is the graph of $p(x)$ increasing? Justify your answer.

P is increasing on the interval $(-\infty,-3)\cup(3,\infty)$, because $p' > 0$

23. At what value(s) of x does the graph of $p(x)$ reach a relative maximum? Justify your answer.

P(x) has a RMAX at $x=-3$, because p' changes from positive to negative

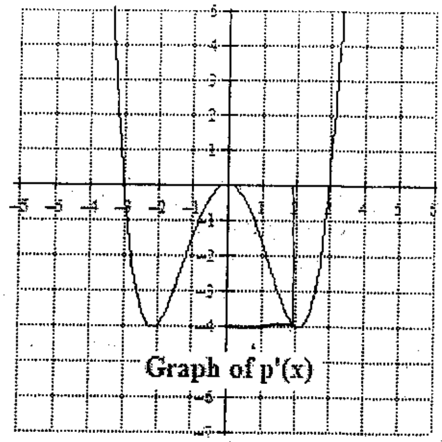
24. At what value(s) of x does the graph of $p(x)$ reach a relative minimum? Justify your answer.

P(x) has a RMIN at $x=3$, because p' changes from negative to positive

25. Approximate the value of $p(1.8)$ using the tangent line approximation if $p(2) = -3$.

$$y + 3 = -4(x-2)$$
$$y = -4x + 5$$
$$y = -4(1.8) + 5$$
$$y = -2.2$$

Pictured to the right is a graph of $p'(x)$, the derivative of a polynomial function, $p(x)$. Use the graph to answer the questions 21 – 25.



21. On what interval(s) is the graph of $p(x)$ decreasing? Justify your answer.

P is dec on the intervals $(-3,3)$, because $P' < 0$.

22. On what interval(s) is the graph of $p(x)$ increasing? Justify your answer.

P is inc on the intervals $(-\infty,-3) \cup (3,\infty)$, because $P' > 0$.

23. At what value(s) of x does the graph of $p(x)$ reach a relative maximum? Justify your answer.

P(x) has a RMAX at $x=-3$, because p' changes from + to −.

24. At what value(s) of x does the graph of $p(x)$ reach a relative minimum? Justify your answer.

P(x) has a RMIN at $x=3$, because p' changes from − to +.

25. Approximate the value of $p(1.8)$ using the tangent line approximation if $p(2) = -3$.

$y-(-3) = m(x-2)$

$y-(-3) = -4(1.8-2)$

$y + (+3) = 0.8$

$-3 \quad -3$

$\boxed{y = -2.2}$