Section A - Selected Response (40 marks)

Directions: Place the letter corresponding to the correct answer on the answer sheet provided.
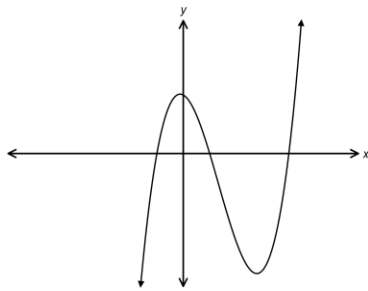
1. Which of the following are polynomial functions?

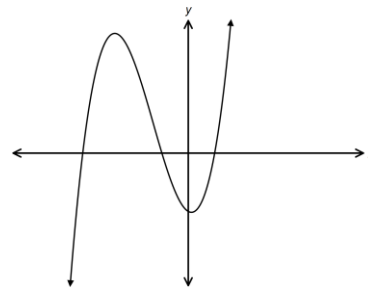| I	$y = x^3 - 2\sqrt{x} + 3$
II	$y = x^3 - \dfrac{2}{x^2} - x - 2$
III	$y = x^3 - 2x^{\frac{3}{2}} + x + 3$
IV	$y = x^3 - \dfrac{1}{2}x^2 - x + 3$

   A) III only
   B) IV only
   C) I and IV only
   D) II and III only

2. Which sketch best represents the graph of $y = ax^3 - bx^2 + cx + 4$ if $a < 0$?

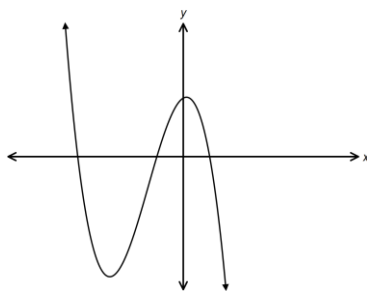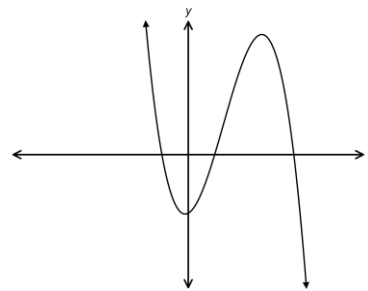   A)

   B)

   C)

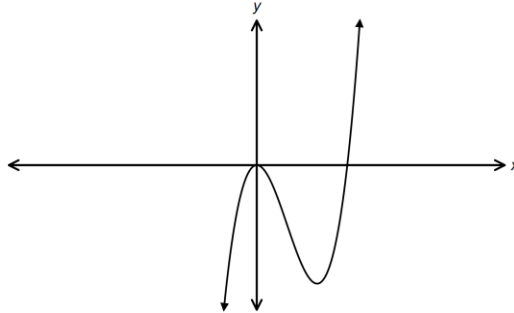

   D)

3. Which of the following is **true** for the graph of a polynomial function with degree 4?

       A) There will be a minimum of one x-intercept.
       B) There will be a maximum of one x-intercept.
       C) There will be a minimum of four x-intercepts.
       D) There will be a maximum of four x-intercepts.

4. A polynomial function is sketched below, what is equation of this polynomial function?

       A) $y = x(x-4)^2$
       B) $y = x(x+4)^2$
       C) $y = x^2(x-4)$
       D) $y = x^2(x+4)$

5. Which three expressions are factors of $x^3 + 2x^2 - 16x - 32$?

I	$x-4$
II	$x+4$
III	$x-2$
IV	$x+2$

       A) I, II, III only
       B) I, II, IV only
       C) I, III, IV only
       D) II, III, IV only

6. A polynomial function $P(x)$ is divided by $x+3$, and the remainder is 2. Which of the following points must be on the graph?

       A) $(-3, 2)$
       B) $(-3, 0)$
       C) $(2, -3)$
       D) $(3, 2)$

7. Raj used synthetic division to divide a polynomial $f(x)$ by $x-2$ as shown below.

$$\underline{2|}\ \ 1 \quad\quad -3 \quad\quad k \quad\quad -5$$

$$\rule{4cm}{0.4pt}$$
$$-1$$

Determine the value of k that will give a remainder of -1 as shown in the table.

A) 1
B) 4
C) 5
D) 6

8. What is the remainder when the function $f(x) = x^3 - 3x^2 + 6$ is divided by $x-1$?

A) 0
B) 2
C) 4
D) 6

9. What are the possible integral roots for $f(x) = 2x^3 - x^2 + 5x - 12$?

A) $\{1, 2, 3, 4, 6, 12\}$

B) $\{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12\}$

C) $\left\{\pm\dfrac{1}{2}, \pm\dfrac{3}{2}\right\}$

D) $\left\{\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 12, \pm\dfrac{1}{2}, \pm\dfrac{3}{2}\right\}$

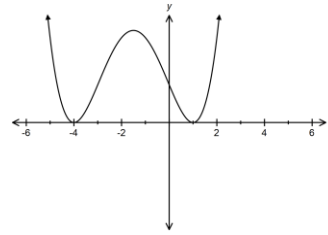10. If $3x^3 + 2x^2 + x - 4$ is divided by $x-1$, which of the following is true?

A) $(x-1)(3x^2 + 5x + 6) + \dfrac{2}{x-1} = 3x^3 + 2x^2 + x - 4$

B) $(x-1)(3x^2 + 5x + 6) + \dfrac{-10}{x-1} = 3x^3 + 2x^2 + x - 4$

C) $(x-1)(3x^2 - x + 2) + \dfrac{-6}{x-1} = 3x^3 + 2x^2 + x - 4$

D) $(x-1)(3x^2 - x) + \dfrac{-4}{x-1} = 3x^3 + 2x^2 + x - 4$

11. Which of the following graphs has a multiplicity of 2 at x = -1 and a multiplicity of 2 at x = 4 and a negative leading coefficient.
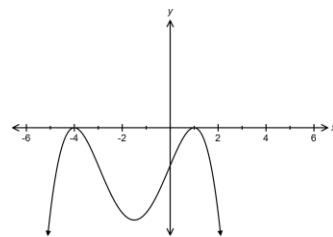
A)
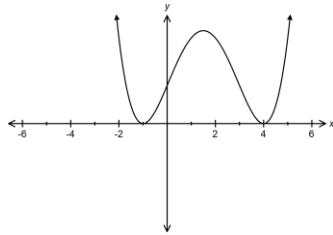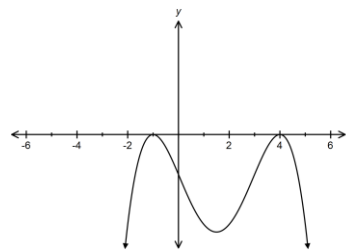

B)

C)

D)

12. The graph of $y = f(x)$ is stretched horizontally by a factor of $\dfrac{1}{4}$. Which equation represents the transformational graph?

 A) $y = \dfrac{1}{4} f(x)$

 B) $y = 4\, f(x)$

 C) $y = f\left(\dfrac{1}{4}x\right)$

 D) $y = f(4x)$
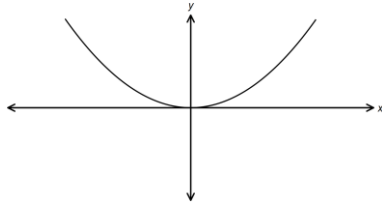
13. The point $P(4, 6)$ lies on the graph of $y = f(x)$. What is the image point under the transformation

$y = -\dfrac{1}{2} f(\dfrac{1}{2}(x+4))$?
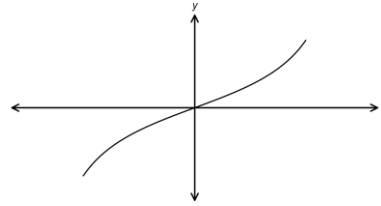
 A) $(4, -12)$

 B) $(4, -3)$

 C) $(-3, 4)$

 D) $(-2, -3)$

14. Which of the following graphs is a function and has an inverse that is also a function?
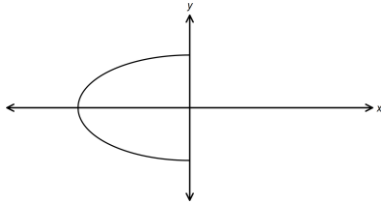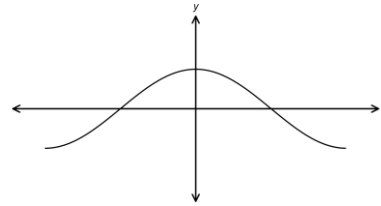
A)

B)

C)

D)

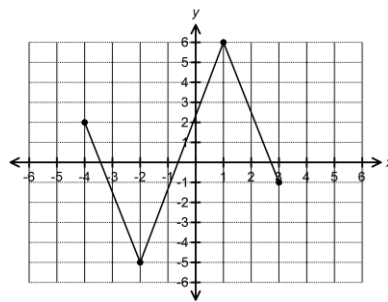15. What is the equation of the inverse of $f(x) = 4x^2 + 10$?

A) $f^{-1}(x) = \dfrac{\pm\sqrt{x-10}}{2}$

B) $f^{-1}(x) = \pm\sqrt{x - \dfrac{5}{2}}$

C) $f^{-1}(x) = \pm\sqrt{\dfrac{x-10}{2}}$

D) $f^{-1}(x) = \pm\sqrt{x} - \dfrac{5}{2}$

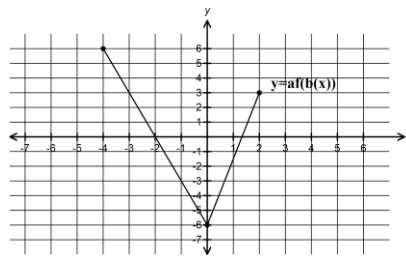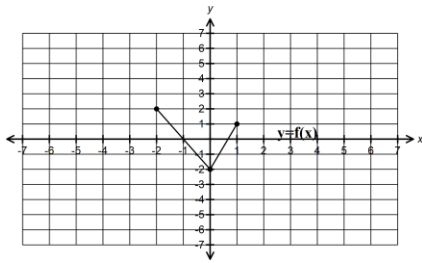16. Given the graph of $y = g(x)$, what is the range?

A) $[-5,6]$

B) $[-4,3]$

C) $(-5,6)$

D) $(-4,3)$

17. What is the vertical stretch factor of $y = a(f(b(x)))$ when compared to $y = f(x)$?


   A) –3
   B) –2
   C) 2
   D) 3

18. Given mapping notation $y = 2f(-3x+6)+1$, what is the horizontal translation of $y = f(x)$?

   A) 2 units left
   B) 2 units right
   C) 6 units left
   D) 6 units right

19. Given the function $f(x) = x^2 - 4x + 4$, which of the following restriction must be applied to $f(x)$ so that $f^{-1}(x)$ is a function?

   A) $\{x / x \geq -2, x \in R\}$
   B) $\{x / x \geq 0, x \in R\}$
   C) $\{x / x \geq 2, x \in R\}$
   D) $\{x / x \geq 4, x \in R\}$

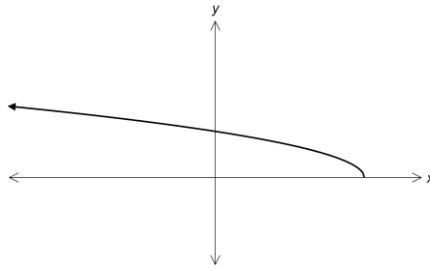20. The graph of $y = f(x)$ as shown below is transformed to $x = f(y)$. Determine the invariant point(s).
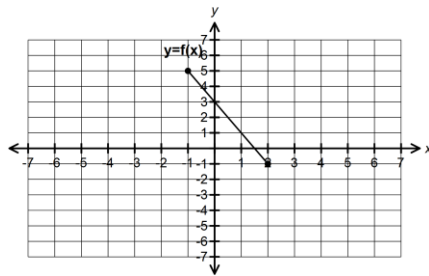
   A) $(0,3)$
   B) $(1,1)$
   C) $(2,-1)$
   D) $(1,1)$ and $(2,-1)$

21. Which of the following functions reflects $y = \sqrt{x}$ on the y axis and transforms it 2 units to the left and 4 units up?

    A) $y = -\sqrt{x+2} + 4$

    B) $y = -\sqrt{x-2} + 4$

    C) $y = \sqrt{-(x+2)} + 4$

    D) $y = -\sqrt{x+2} - 4$

22. Which function best represents the graph below ?

    A) $y = \sqrt{-(x+4)}$

    B) $y = \sqrt{-(x-4)}$
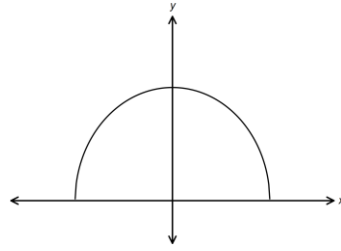
    C) $y = -\sqrt{x+4}$

    D) $y = -\sqrt{x-4}$

23. Which is true for the function $y - 3 = \sqrt{4x+8}$ when compared to $y = \sqrt{x}$?

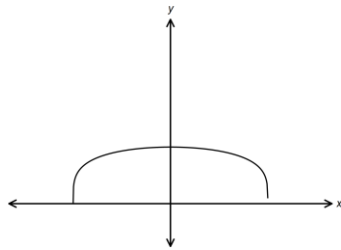|	Vertical Translation	Horizontal Translation
A)	3	-8
B)	3	-2
C)	-3	-2
D)	-3	8

24. If $f(x) = -3x + 6$, what is the domain of $y = \sqrt{f(x)}$?

    A) $\{x / x \le -2, x \in R\}$

    B) $\{x / x \le 2, x \in R\}$

    C) $\{x / x \ge 0, x \in R\}$

    D) $\{x / x \ge 2, x \in R\}$

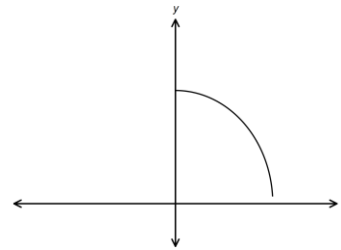25 Given the graph of $f(x) = \sqrt{16-x^2}$ as shown, which of the following is the graph of $y = \sqrt{f(x)}$?

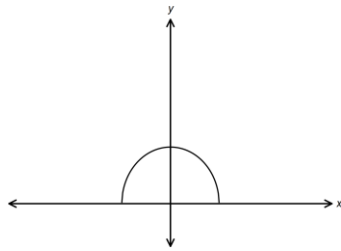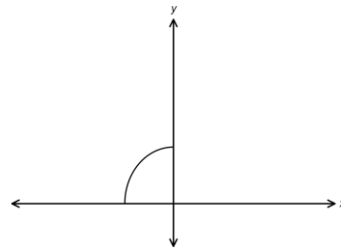A)   B)

C)   D)

26. What are all the invariant points for the graph of $f(x) = 4x^2$ and $y = \sqrt{f(x)}$?

A) $(0,0)$

B) $\left(-\frac{1}{4}, 0\right), (0,0)$

C) $\left(-\frac{1}{2}, 1\right), \left(\frac{1}{2}, 1\right)$

D) $\left(-\frac{1}{2}, 1\right), (0,0), \left(\frac{1}{2}, 1\right)$

27. If $f(x) = x^2 - 49$, what is the **domain** of $y = \sqrt{f(x)}$?

    A) $\{x / x \in R\}$

    B) $\{x / x \geq 0, x \in R\}$

    C) $\{x / -7 \leq x \leq 7, x \in R\}$

    D) $\{x / x \leq -7 \ or \ x \geq 7, y \in R\}$

28. What is $330°$ as a radian measure?

    A) $\dfrac{11}{12}\pi$

    B) $\dfrac{11}{6}\pi$

    C) $\dfrac{11}{3}\pi$

    D) $\dfrac{13}{12}\pi$

29. What is the length of an arc cut off by a $\dfrac{3}{4}\pi$ sector in a circle with a diameter of 40 cm?

    A) $\dfrac{15}{2}\pi$ cm

    B) 15π cm

    C) 30π cm

    D) $\dfrac{160}{3}\pi$

30. Solve for x: $\cos x = \dfrac{\sqrt{3}}{2}$ $0 \leq x \leq 2\pi$

    A) $\dfrac{\pi}{6}, \ \dfrac{5}{6}\pi$

    B) $\dfrac{\pi}{6}, \ \dfrac{11}{6}\pi$

    C) $\dfrac{\pi}{3}, \ \dfrac{2}{3}\pi$

    D) $\dfrac{\pi}{3}, \ \dfrac{5}{3}\pi$

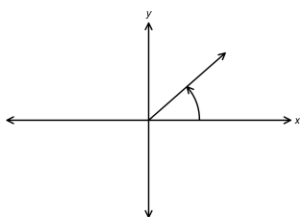31. Which expression represents all angles coterminal with a standard position angle measuring $120°$?

A) $\dfrac{5}{6}\pi \pm \pi n, \ n \in W$

B) $\dfrac{2}{3}\pi \pm \pi n, \ n \in W$

C) $\dfrac{5}{6}\pi \pm 2\pi n, \ n \in W$

D) $\dfrac{2}{3}\pi \pm 2\pi n, \ n \in W$

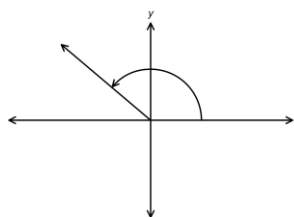32. In which quadrant is tan positive and csc negative?

A) I
B) II
C) III
D) IV

33. Which of the following represents an angle in standard position measuring $\dfrac{5}{4}\pi$ radians?

A)

B)

C)

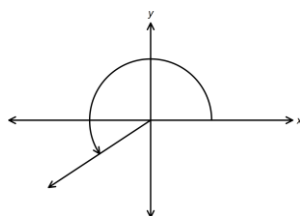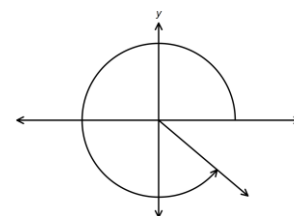
D)

34. Which of the following pairs of trigonometric ratios have the same value as $\sec 307°$.

A) $\sec(-53°) \ and \ \sec(-127°)$

B) $\sec(-53°) \ and \ -\sec(127°)$

C) $-\sec(53°) \ and \ \sec(-127°)$

D) $-\sec(53°) \ and \ -\sec(127°)$

35. If angle A has a measure of $\frac{4}{3}\pi$ radians. What are the exact values of $\cos A$ *and* $\sin A$?

A) $\cos A = -\frac{\sqrt{3}}{2}$ *and* $\sin A = -\frac{1}{2}$

B) $\cos A = -\frac{\sqrt{3}}{2}$ *and* $\sin A = \frac{1}{2}$

C) $\cos A = -\frac{1}{2}$ *and* $\sin A = -\frac{\sqrt{3}}{2}$

D) $\cos A = -\frac{1}{2}$ *and* $\sin A = \frac{\sqrt{3}}{2}$

36. Angle θ is in the fourth quadrant with $\tan\theta = -\frac{12}{5}$. What is the exact value of $\sin\theta$?

A) $-\frac{12}{13}$

B) $-\frac{5}{13}$

C) $\frac{5}{13}$

D) $\frac{12}{13}$

37. What characteristic is different for the graphs of $y = \sin x$ and $y = \cos x$?

A) Amplitude
B) Horizontal Central Axis
C) Period
D) Y intercept

38. Given the function $y = 2\cos 3(x + 45°)$, what is the amplitude of its graph?

A) $\frac{1}{3}$

B) $\frac{1}{2}$

C) 2

D) 3

39. Given the function $f(x) = 3 \sin\left(\dfrac{1}{2}x\right)$, what is the period of its graph?

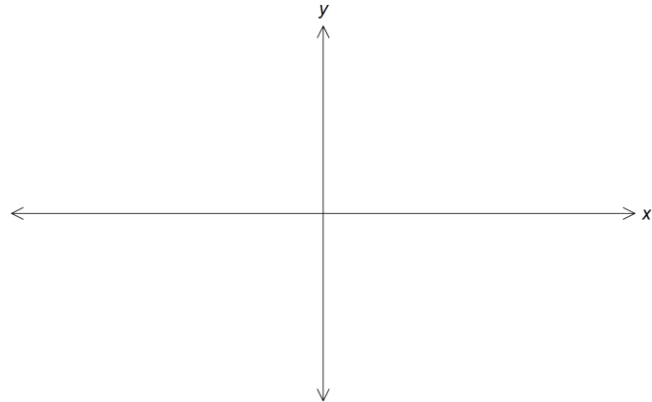   A) 120°
       B) 180°
       C) 720°
       D) 1080°

40. What is the maximum value for the function $y = -5 \sin(2x) + 3$?

       A) -8
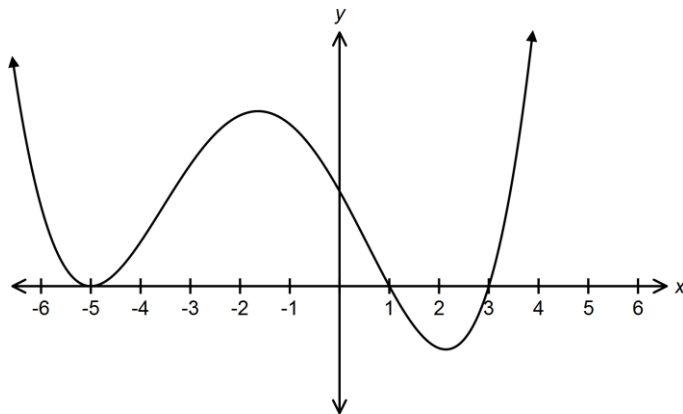   B) -2
       C) 5
       D) 8

Section B - Constructed Response (40 marks)

Directions: Answer all questions on the examination paper and show your workings.

1. Sketch the graph of the function $y = 2x^3 - 3x^2 - 3x + 2$ and clearly label the x intercept(s) and y intercept.
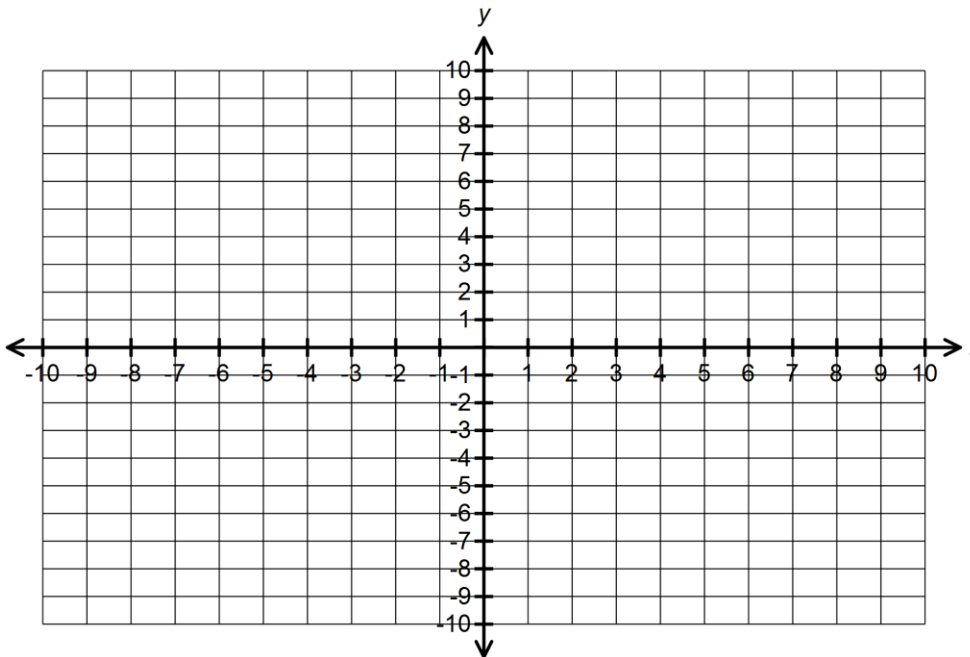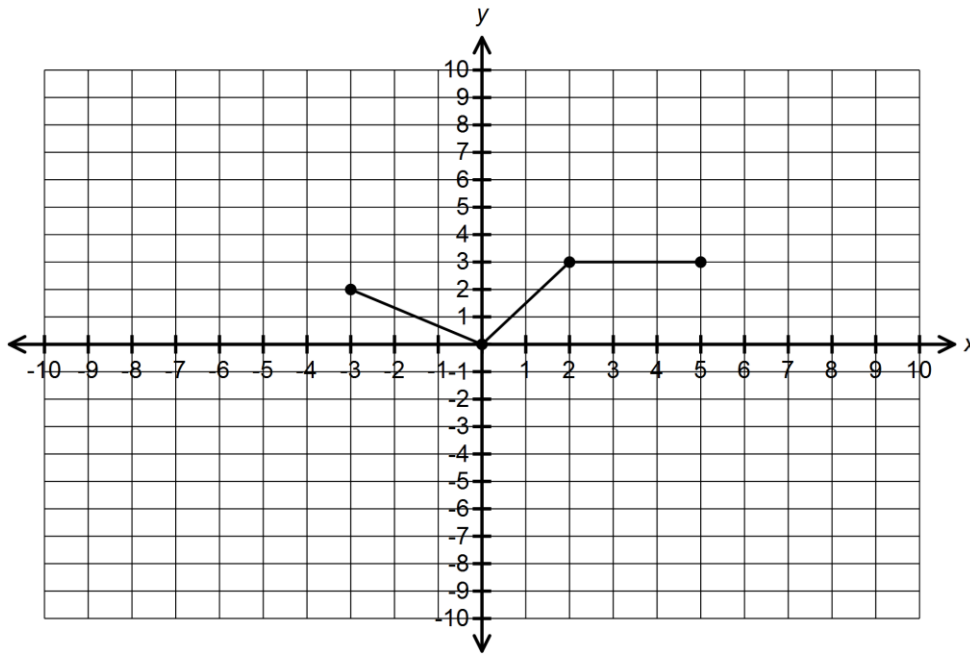
(4 marks)

2. Write the equation for the graph of the polynomial function below that passes through the point $(5, 30)$.

(4 marks)

3. The length, width and height of a rectangular prism are x cm, $(x+4)$ cm and $(x+5)$ cm respectively. Write an expression for the volume in the form $f(x) = ax^3 + bx^2 + cx + d$ and find the dimension of the solid if the volume is 168 cm^3. **(4 marks)**

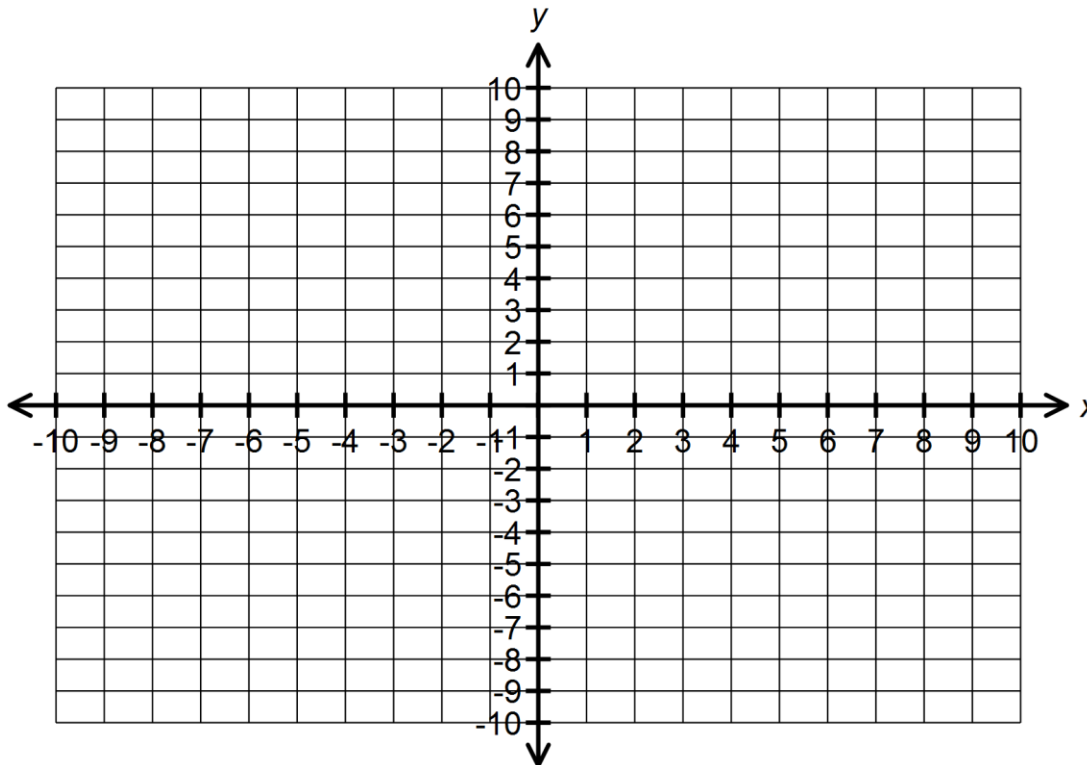4. Given the graph of the function $y = f(x)$ shown, Sketch the graph of $y = 2(f(-x)) - 3$.

(4 marks)

5. The graph of $y = f(x)$ with points $A(-4,-3)$, $B(-1,-6)$, $C(3,3)$, $D(5,-3)$ is transformed so that $A'(-8,4)$, $B'(-2,5)$, $C'(6,2)$, $D'(10,4)$. Plot the points and determine the equation of the image function in the form $y = a\,f(b(x-h)) + k$. **(4 marks)**
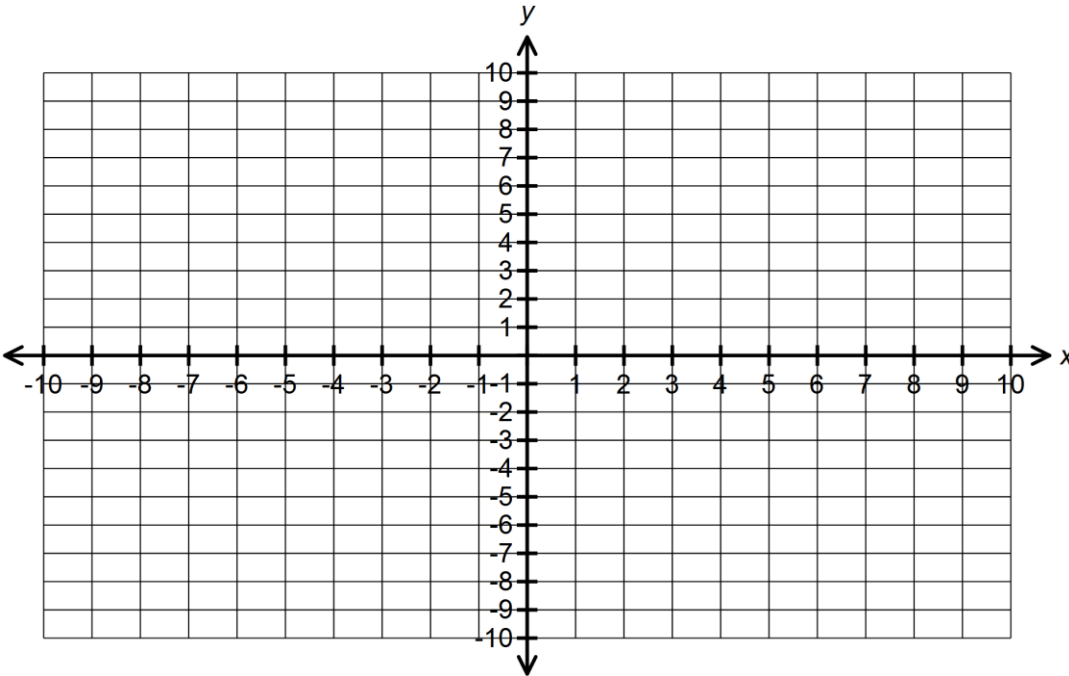
6. If $f(x) = x - 2$ sketch the graph of $f(x)$ and $y = \sqrt{f(x)}$ using a table of values. Label the invariant point(s). **(4 marks)**
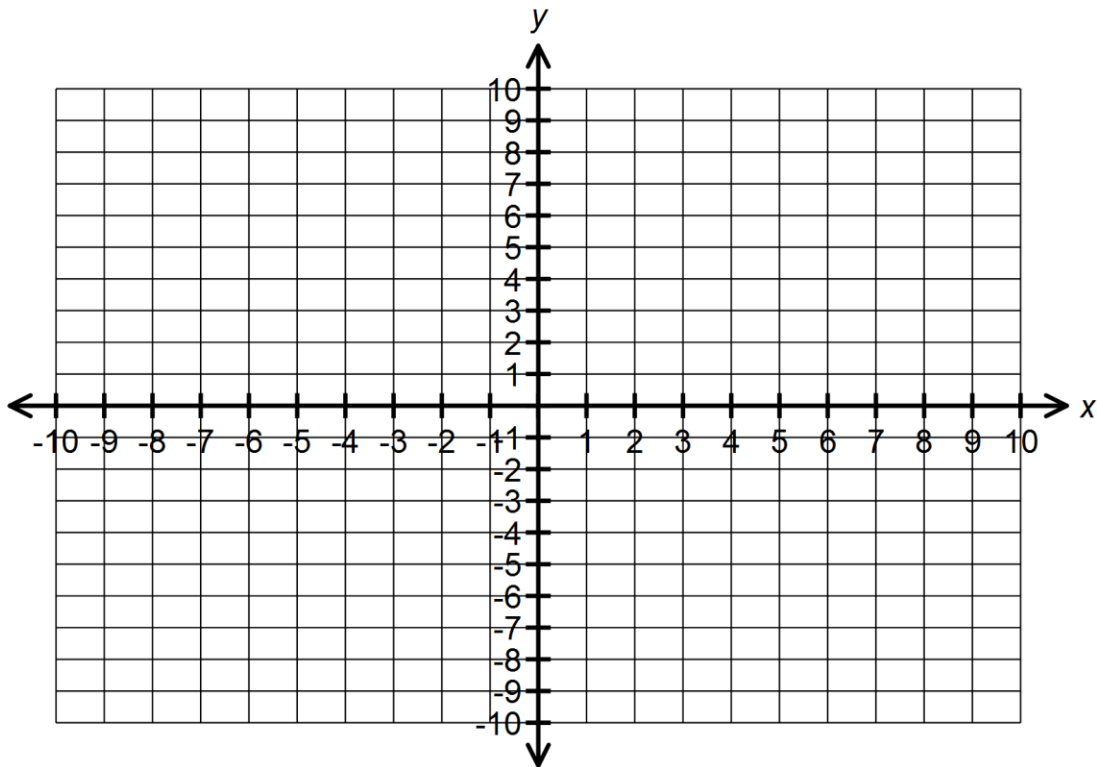
X	$f(x)$

X	$\sqrt{f(x)}$

7. Solve graphically $\sqrt{25 - x^2} = 3$ **(4 marks)**

X	Y

X	Y

8. Find the **exact** value for $\dfrac{\cot\left(\dfrac{\pi}{3}\right)+\cos\left(\dfrac{5}{3}\pi\right)}{\csc(-240°)}$ **(4 marks)**

9. Solve for θ : $2\cos^2\theta-\cos\theta-1=0$ $0\leq\theta<2\pi$ **(4 marks)**

10. Graph $y = 5\left(\sin\left(\dfrac{1}{2}\left(x + \dfrac{3}{2}\pi\right)\right)\right) + 2$ 　　　　　**(4 marks)**